
REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release
or Threatened Release of Hazardous Substances in Region 5

FINAL SITE-SPECIFIC PLANS

OU1 of the Eagle Zinc Site

Hillsboro, Montgomery County, Illinois

Remedial Design

W.A. No. 067-RDRD-B547/Contract No. EP-S5-06-01

July 2010

~~PREPARED FOR~~

U.S. Environmental Protection Agency



PREPARED BY

CH2M HILL

Environmental Design International, Inc.

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Attachments

Attachment A:	HAZWOPER Certifications
Attachment B:	Field Sampling Plan
Attachment C:	Site Management Plan
Attachment D:	Health and Safety Plan
Attachment E:	Example Lumex Mercury Analyzer SOP
Attachment F:	Laboratory Provided Analytical SOPs

**QAPP Worksheet #1
Title and Approval Page**

Site Name/Project Name: Eagle Zinc Remedial Design

Title: UFP QAPP for OU1 of the - Eagle Zinc Site

Site Location: Eagle Zinc Site in Hillsboro, IL

Revision Number: 0

Revision Date: June 16, 2010

Document Title: Quality Assurance Project Plan (QAPP) Eagle Zinc Superfund Site OU1 – Building Demolition

Lead Organization: United States Environmental Protection Agency (USEPA)

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Preparation Date (Day/Month/Year): 28 June 2010

EDI Project Manager Patricia Feeley: _____
Signature/ Date

EDI QAO Gary Flentge: _____
Signature/ Date

CH2M HILL's Site Manager Lisa Cundiff: _____
Signature/ Date

Approval Signatures: _ _____
Signature

Printed Name/Title/Date

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Eagle Zinc/Remedial Design	Title: QAPP
Site Location: Hillsboro, IL	Revision Number: 0
Site Number/Code: ILD 980606941	Revision Date: 06/16/2010
Operable Unit: OU1	Page ____ of ____
Contractor Name: CH2M HILL and Environmental Design International Inc.	
Contractor Number: EP-S5-06-01	
Contract Title: Remedial Action Contract	
Work Assignment Number: 067-RDRD-B5Y7	

1. Identify guidance used to prepare QAPP: UFP-QAPP Manual
2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
3. Identify approval entity: USEPA
4. Indicate whether the QAPP is a generic or a project-specific QAPP. Project Specific QAPP
5. List dates of scoping sessions that were held: See Worksheet #9
6. List dates and titles of QAPP documents written for previous site work, if applicable:

Not Applicable
7. List organizational partners (stakeholders) and connection with lead organization:
 - US Environmental Protection Agency (USEPA) – Lead Agency
 - Illinois Environmental Protection Agency (IEPA) – Regulatory Stakeholder
 - CH2M HILL – USEPA Contractor
8. List data users: USEPA, IEPA, and CH2M HILL

QAPP Worksheet #3
Distribution List

Report Title:

UFP-QAPP for OU1 of the Eagle Zinc Site

Distribution List

QAPP Recipients	Title	Organization	E-mail Address	No. of Copies
Nefertiti Simmons	Work Assignment Manager (WAM)	USEPA Region 5	Simmons.Nefertiti@epamail.epa.gov	2
Ike Johnson	Program Manager (PM)	CH2M HILL	ike.johnson@ch2m.com	1 ^a
Lisa Cundiff	Site Manager (SM)	CH2M HILL	lisa.cundiff@ch2m.com	1
Patricia Feeley	Team Subcontractor	EDI	pfeeley@envdesigni.com	1
Chuck Ouellette	Demolition Leader	CH2M HILL	chuck.ouellette@ch2m.com	1 ^a
Scott Hutsell	Design Leader	CH2M HILL	scott.hutsell@ch2m.com	1 ^a
Lisa Schwan	Waste Management	CH2M HILL	lisa/schwan@ch2m.com	1 ^a

Note: ^aElectronic submittal

QAPP Worksheet #4
Project Personnel Sign-Off Sheet

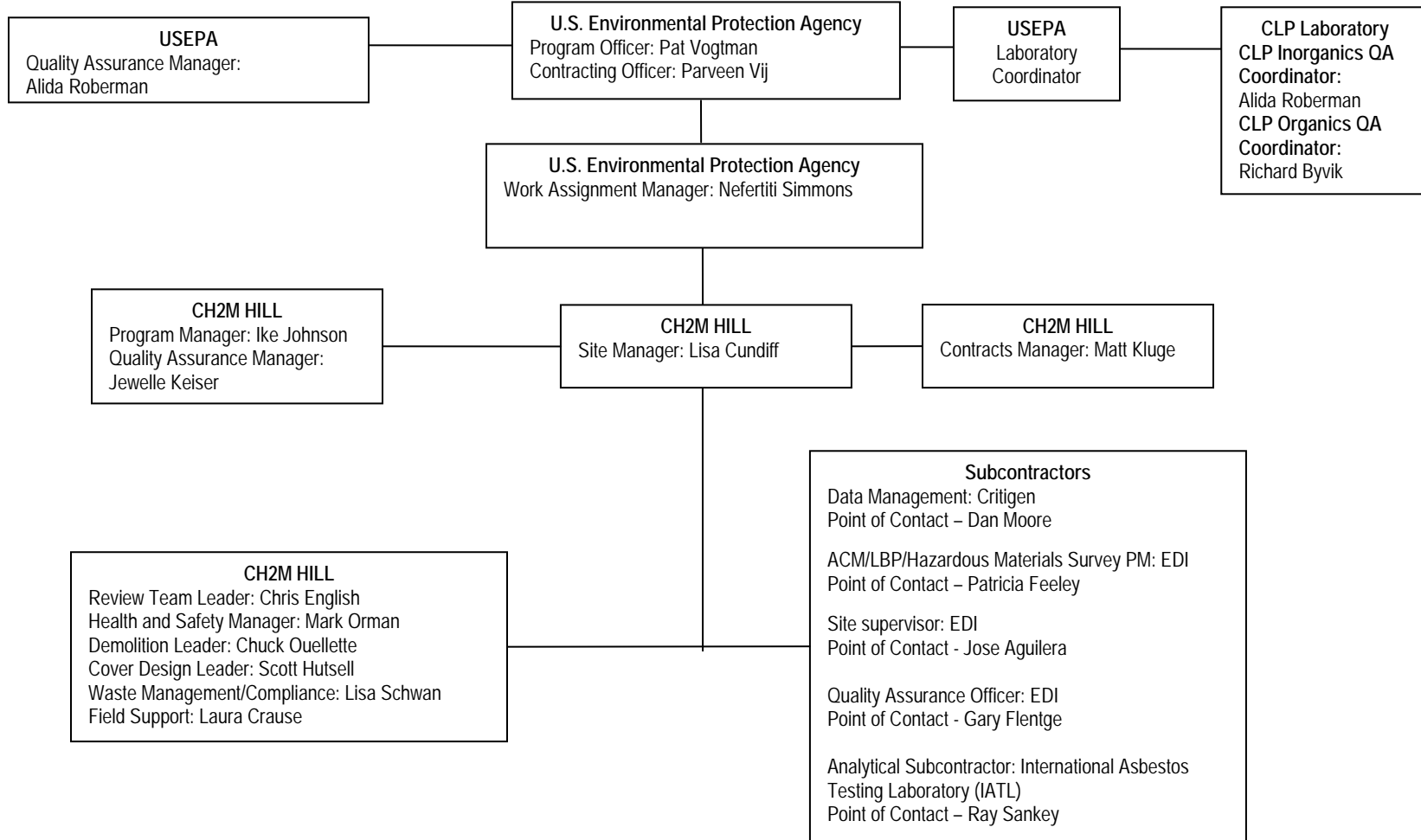
Organization: Environmental Design International Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Patricia Feeley	EDI RAC Project Manager	312-345-1400 Ext 136		6/16/2010
Jose Aguilera	EDI Site Supervisor	Ext 137		6/16/2010
Gary Flentge	EDI Quality Assurance Officer (QAO)	Ext 143		6/16/2010

Organization: CH2M HILL

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Lisa Cundiff	SM	314-335-3010		6/16/2010
Ike Johnson	PM	414-847-0304		
Chuck Ouellette	Demolition Leader	617-901-4859		
Scott Hutsell	Cover Design Leader	517-505-1301		
Lisa Schwan	Waste Management	404-414-2505		

QAPP Worksheet #5 Project Organizational Chart



QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
USEPA Communication regarding plans and site investigation.	USEPA Program Officer (PO)	Pat Vogtman	312-886-9553	Provides administrative direction to CH2M HILL Program Manager and project team, authorizes changes to plan and can stop work, if needed.
USEPA Communication regarding budget and costs	USEPA Contracting Officer (CO)	Parveen Vij	312-353-1173	Provides administrative direction to CH2M HILL Contracts Manager.
Communication with USEPA Program Officer and Contracting Officer	PM	Ike Johnson	414-847-0304	Serves as Primary point of contact for USEPA and notifies USEPA of contractual work deviations (scope cost or schedule changes).
Communication with CH2M HILL Site Manager	WAM	Nefertiti Simmons	312-886-6148	Serves as primary point of contact for USEPA and provides approval of technical direction to CH2M HILL Site Manager.
Point of Contact for USEPA WAM	SM	Lisa Cundiff	314-335-3010	Serves as primary point of contact for CH2M HILL, provides technical support to WAM and directs project team.
Point of Contact for Team Subcontractor Field Investigation Team	EDI RAC Project Manager	Patricia Feeley	312-345-1400 ext. 136 C – 312-446-2400	Primary point of contact for CH2M HILL SM for direction of field activities.
Field sampling issues during onsite activities.	EDI Site Supervisor	Jose Aguilera	312-285-5006	Primary point of contact for field staff sampling and EDI Project Manager.

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Health and Safety	Site Safety Officer	Kristen Templin	313-657-3501	Responsible for the adherence of team members to the Health and Safety Plan (HSP). Will report health and safety incidents and near misses to
Quality Assurance data review	QAO	Gary Flentge	312-345-1400 ext. 143	Responsible for review of data for quality control.
Demolition Leader	Demolition Design	Chuck Ouellette	617-901-4859	Responsible for the development of the demolitions work plan.
Cover Design Leader	Design Engineer	Scott Hutsell	517-505-1301	Responsible for the design of the onsite soil cover.
Waste Manager		Lisa Schwan	404-414-2505	Responsible for development of the waste management plan.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Ike Johnson	PM	CH2M HILL	Receives contractual direction from USEPA and provides feedback on changes in scope of work, budget, and schedule.	MS and 30 years experience
Lisa Cundiff	SM	CH2M HILL	Manages and supports CH2M HILL's project team, tracks project budget, field activities, and schedule.	MS and 24 years experience
Patricia Feeley	EDI Team Project Manager	EDI	Manages and supports field sampling team for quality sampling, sample submission, and review of data deliverables.	MS and 18 years experience, HAZWOPER 40 hour & 8 hour Refresher
Gary Flentge	QAO	EDI	Quality assurance of data deliverables	MS and 20 years experience, HAZWOPER 40 hour & 8 hour Refresher, Asbestos and Lead licenses.
Jose Aguilera	Site Supervisor	EDI	Asbestos inspector, lead on asbestos sampling and residual sampling, oversight of overall sampling team and onsite activities.	HAZWOPER 40 hour and 8-hour Refresher Licensed by IDPH for Asbestos
Paul Kybartas	Lead Inspector	EDI	Asbestos inspector and Lead inspector. Lead on lead inspection with XRF and paint chip sampling.	HAZWOPER 40 hour and 8-hour Refresher Licensed by IDPH for Asbestos and Lead
Kristen Templin	Environmental Scientist and Site Safety Officer	EDI	Sample Management for CLP and Site Safety	HAZWOPER 40 hour and 8-hour Refresher

QAPP Worksheet #7
Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Chuck Ouellette	Civil Engineer	CH2M HILL	Design of the demolition work plan	20 years experience
Scott Hutsell	Civil Engineer	CH2M HILL	Design of the onsite soil cover	19 years experience
Lisa Schwan	Environmental Manager/CHMM	CH2M HILL	Waste Management	21 years experience

QAPP Worksheet #8
Special Personnel Training Requirements

Project Function	Specialized Training – Title or Description of Course	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates¹
Asbestos Sampling	Asbestos Inspector course	Field staff for asbestos sampling	Field Team Lead, EDI	See Field Sampling Plan (FSP) Appendix A
Lead risk analysis	Lead risk Assessor course	Field staff for lead sampling	Field Team Lead, EDI	See FSP Appendix A
Field Activities	HAZWOPER 40 hour and 8-hour Refresher	All onsite field staff for sampling activities.	Field Team Staff/ EDI and CH2M HILL	Attached to QAPP Attachment A

¹If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

QAPP Worksheet #9 – Project Scoping Sessions

Project scoping sessions were held throughout the work planning process and development of the site-specific plans. Some sessions were held among internal team members and others included team subcontractors or USEPA. The team identified data gaps and uncertainties to develop the current understanding of the current conditions of the onsite buildings (OU1). The technical approach was developed for filling data gaps and performing field investigations. A site visit was conducted to verify current site conditions and support the strategy development for sampling locations.

Site Name: **OU1 of the Eagle Zinc Site**
Site Location: **Hillsboro, Illinois**
Project Name: **OU1 Remedial Design**
Projected Date(s) of Sampling: **July 2010**
Site Manager: **Lisa Cundiff**

Date of Session: March 19, 2010

Scoping Session Purpose: Work Assignment 067 Kick-Off Call

Name	Title/Role	Affiliation	Phone #	E-mail Address
Pat Vogtman	PO	USEPA	(312) 886-9553	Vogtman.Pat@epamail.epa.gov
Parveen Vij	CO	USEPA	(312) 353-1173	Vij.Parveen@epamail.epa.gov
Nefertiti Simmons	WAM	USEPA	(312) 886-6148	Simmons.Nefertiti@epamail.epa.gov
Ike Johnson	PM	CH2M HILL	(414) 847-0304	Ike.Johnson@CH2M.com
Lisa Cundiff	SM	CH2M HILL	(314) 335-3010	Lisa.Cundiff@CH2M.com

- Decisions:
 - CH2M HILL will evaluate the ability to recycle as much of the metal and brick as possible.
 - USEPA indicated that the rail track and railroad ties are not to be included in the scope.
 - CH2M HILL to conduct a site visit with the demolition lead engineer and the cover system design engineer as well as our partner EDI (who will conduct the ACM, lead-based paint (LBP), hazardous material surveys).
- Action Items:
 - USEPA to verify with their contract laboratory program to whether or not they can perform analyses for asbestos, lead chips, and wipe samples. USEPA will amend the statement of work (SOW) accordingly.
 - CH2M HILL will prepare the draft Work Plan for USEPA review.

Date of Session: March 23, 2010

Scoping Session Purpose: Internal Work Assignment 067 Kick-Off Call

Name	Title/Role	Affiliation	Phone #	E-mail Address
Chuck Ouellette	Demolition Lead	CH2M HILL	(617) 901-4859	Chuck.Ouellette@CH2M.com
Lisa Schwan	Waste Characterization	CH2M HILL	(404) 414-2505	Lisa.Schwan@CH2M.com
Scott Hutsell	Cover Design	CH2M HILL	(517) 505-1301	Scott.Hutsell@CH2M.com
Lisa Cundiff	SM	CH2M HILL	(314) 335-3010	Lisa.Cundiff@CH2M.com

- Discussions:
 - Project overview discussion and question and answer based on team's review of the SOW
 - Roles and responsibilities of team members for the draft work plan effort
 - Team members' schedules discussed to determine availability to participate in the work planning effort
 - Task list developed
- Action Items:
 - SM and Cover Design Leader will conduct the site visit March 30. SM, Demolition Design Leader, and EDI will conduct site visit on April 1st. Need to conduct two separate site visits to accommodate team members schedules.

Date of Session: March 30, 2010

Scoping Session Purpose: Site Visit with Cover Design Leader

Name	Title/Role	Affiliation	Phone #	E-mail Address
Scott Hutsell	Cover Design	CH2M HILL	(517) 505-1301	Scott.Hutsell@CH2M.com
Lisa Cundiff	SM	CH2M HILL	(314) 335-3010	Lisa.Cundiff@CH2M.com

- Discussions:
 - Discussed the location for the onsite cell and cover system and walked the site to evaluate conditions along the southern property where the cover system will be placed in order to support design.
 - Reviewed assumptions for the area and volume estimates for the cover design.

Decisions:

- Will use the assumptions and volume estimates presented in the record of decision for the design since the exact volume to be included in the onsite cell will not be known exactly until demolition.
- Action Items:
 - Cover Design Leader to provide level of effort (LOE) and costs for the cover design task.

Date of Session: April 1, 2010

Scoping Session Purpose: Site Visit with Demolition Leader and ACM/LBP Consultant

Name	Title/Role	Affiliation	Phone #	E-mail Address
Chuck Ouellette	Demolition Lead	CH2M HILL	(617) 901-4859	Chuck.Ouellette@CH2M.com
Gary Flentge	ACM/LBP	EDI		gflentge@envdesigni.com
Lisa Cundiff	SM	CH2M HILL	(314) 335-3010	Lisa.Cundiff@CH2M.com

- Discussions:
 - Visited all buildings that were safe to enter and prepared a preliminary list of types of wastes to deal with (LBP, brick, concrete, ACM, hazardous materials).
 - Discussed methods for accessing parts of buildings in support of planning and cost estimating for the ACM and LBP surveys.
- Decisions:
 - A couple of buildings are in such poor condition that it will be very difficult to sample until after demolition.
- Action Items:
 - Demolition Leader and EDI to provide LOE and costs for their associated tasks to the SM in support of the work plan.

Date of Session: April 6, 2010

Scoping Session Purpose: Review site photos with Lisa Schwan and discuss tasks in support of demolition plan and waste management plan

Name	Title/Role	Affiliation	Phone #	E-mail Address
Chuck Ouellette	Demolition Lead	CH2M HILL	(617) 901-4859	Chuck.Ouellette@CH2M.com
Lisa Schwan	Waste Characterization	CH2M HILL	(404) 414-2505	Lisa.Schwan@CH2M.com

Date of Session: April 6, 2010

Scoping Session Purpose: Review site photos with Lisa Schwan and discuss tasks in support of demolition plan and waste management plan

Name	Title/Role	Affiliation	Phone #	E-mail Address
Lisa Cundiff	SM	CH2M HILL	(314) 335-3010	Lisa.Cundiff@CH2M.com

- Discussions:
 - Reviewed photos in a Live Meeting to give Lisa Schwan an idea of the types of buildings and waste that we will be dealing with in support of pulling together LOE and costs for the planning effort.
 - Need to obtain any utility drawings available.
- Decisions:
 - The design documents for the demolition will be in the form of a Demolition Work Plan which covers similar elements as a typical design.
- Action Items:
 - PM to follow-up with EDI to verify the planning for the ACM and LBP sampling.
 - PM to follow-up with WAM to see if utility drawings are available.

Date of Session: June 9, 2010

Scoping Session Purpose: USEPA communication via email regarding the demolition of the rail line onsite

Name	Title/Role	Affiliation	Phone #	E-mail Address
Nefertiti Simmons	WAM	USEPA	(312) 886-6148	Simmons.Nefertiti@epamail.epa.gov
Lisa Cundiff	SM	CH2M HILL	(314) 335-3010	Lisa.Cundiff@CH2M.com

- Discussions:
 - USEPA directed CH2M HILL to include the onsite rail lines in the demolition plan for OU1.
- Decisions:
 - Onsite rail lines will be included in the demolition plan.

QAPP Worksheet #10

Problem Definition

The purpose of this sampling investigation, as defined in the RAC II Region 5 SOW dated March 8, 2010, is to collect site specific data to develop a remedial design for building demolition. A Record of Decision (ROD) has been issued for this site. A remedial design is needed prior to implementation of phased remedial action.

10.1 Project Background & Previous Investigations

The site is located in a mixed industrial/commercial/residential area in Hillsboro, Montgomery County, Illinois. The site is approximately 132 acres with about 30 acres of buildings and associated structures. There are about 23 buildings onsite that were previously used for facility operations; the types of buildings include offices, laboratories, manufacturing/processing, equipment/raw material/finished product storage, bag houses and maintenance facilities. Also located onsite are railroad spurs, residual material, two stormwater retention ponds, a small pond and several roads. Active industrial operations ceased in 2003. The area has been zoned commercial/industrial and there are no plans to rezone the area for other uses.

Previous investigations have taken place since the early 1980s. The initial Remedial Investigation (RI) started in 2001 and a draft RI Report was produced in 2005. The previous investigations show multiple residue piles throughout the site that exceed screening levels. The contaminants of concern onsite include lead and cadmium. Other contaminants onsite include copper, zinc, and manganese. In 2008, the buildings and associated structures onsite were sampled via X-ray Fluorescence (XRF) and revealed significantly high levels of lead concentrations in, on, and around the building structures. This sampling event led the USEPA decision to complete an interim action to address the immediate threat posed by the buildings. A removal action was conducted in January 2009 to quickly mitigate site access and exposure; the action consisted of fence installation around the most accessible areas of the site.

The USEPA has divided the site into two operable units (OUs) to effectively deal with the short-term risks, lead in buildings, and the long-term risks, contaminated soil and groundwater onsite. OU-1 building demolition is the focus of this remedial design.

The selected remedy for OU 1 consists of the following components:

- Building demolition – All buildings and associated above ground structures onsite will be removed via controlled demolition
- Asbestos containing material (ACM) and hazardous materials survey and disposal - An ACM and hazardous materials survey, including universal wastes, polychlorinated biphenyl (PCB)-containing devices, and LBP coated materials, will be conducted on all onsite buildings. Any ACM, universal wastes, and PCB-containing devices will be properly removed and disposed of offsite. LBP-coated debris will be evaluated for proper disposition. For example, LBP on metal will not be removed but recycled in total as scrap metal.

- Recycle – Salvageable material will be recycled or reused. Proceeds from recycling will be used to off-set the cost of the remedy.
- Disposal – Putrescible wastes or unsalvageable materials will be characterized and properly disposed of offsite.
- Onsite consolidation – Remaining debris will be consolidated and placed in the southwest corner of the site.
- Soil cover – A 1-foot soil cover will be placed as a barrier over the contaminated building debris consolidated onsite

10.2 Environmental Questions

What are the characterization and hazards for the building materials, based on planned demolition and disposal?

1. Are there asbestos containing materials on the interior or exterior of the buildings?
2. Are there hazardous levels of lead on the interior or exterior of the buildings, excluding hazardous levels of LBP on metals?
3. Are there hazardous levels of residuals (i.e. product, waste, dust) on interior or exterior building components?
4. Are there universal wastes (such as mercury containing equipment (e.g. thermostats) or PCBs containing equipment (e.g. lighting ballasts or transformers) that can be visually assessed in preparation for building demolition.

10.3 Preliminary Site Reconnaissance and Document Review

A site reconnaissance was conducted on March 31 and April 1, 2010. The site reconnaissance identified 23 buildings, and one building that was structurally unsafe to enter. Suspect ACMs were observed in the buildings. Suspect LBP was observed in and around the buildings. Suspect residual materials were observed in and around the buildings. Suspect universal wastes were observed in and around the buildings. Demolition of one building and some building components may be required prior to material survey due to unsafe conditions. In general, the survey will not be conducted in areas that are not visible or are behind walls.

A lead survey was conducted by Illinois Environmental Protection Agency (IEPA) using XRF sampling in 2008. CH2M HILL's Technical Memorandum, *Review and Description of IEPA XRF Sampling of Waste Materials at the Eagle Zinc Superfund Site*, dated June 23, 2009, states that the results identified high concentrations of lead in and around the buildings, which lead to a concern for hazardous lead levels related to the buildings, and that "about 70% of the samples collected within the building structures exceeded USEPA's target screening level of 800 parts per million (ppm) (for lead), while 100 percent of the samples collected outside the building structures exceeded the 800 ppm screening level. Nine of the ten TCLP (lead) samples exceeded the 5 mg/l TCLP limit for lead and the waste could be hazardous once excavated." The XRF results ranged from <500 ppm to greater than 10,000 ppm. The table of results also identified concentrations of arsenic, zinc, copper, nickel, chromium, barium, and cadmium.

According to the CH2M HILL Remedial Design Work Plan dated April 27, 2010, the contaminants of concern for the onsite residuals include lead, cadmium, copper, zinc, and manganese. Contaminants of concern for OU1 building demolition include ACM, LBP, residuals with high concentrations of metals (specifically lead). Contaminants of concern for universal waste as part of building demolition includes mercury containing or PCBs containing lighting or equipment. Concrete roofing tile will be sampled for asbestos by bulk asbestos sample collection. A former laboratory in the office building had mercury spill kits and a direct read monitoring instrument will be used to assess the building materials in that locations.

10.4 Sampling Plan

A visual survey of each structurally sound building (safe to enter) will be conducted to identify suspect ACM, LBP, residuals, and universal wastes. If suspect materials are identified, then samples will be collected for analysis. Suspect ACM materials will be submitted for laboratory analysis by polarized light microscopy (PLM). Suspect LBP will be analyzed onsite using an XRF direct read instrument. The XRF analysis will focus on non-metal building components, such as concrete with painted surfaces, brick, wood, drywall, and other non-metal painted surfaces. Metal building components can be recycled with LBP in place. Residual dust will be collected via wipe samples or as a dust/dirt sample into a 4-ounce glass sampling container.

The asbestos sampling will consist of three bulk samples per homogenous sampling area. Homogenous sampling areas are materials that are similar in color, texture, and general appearance, and which appear to have been installed in the same time period. Homogenous sampling will be determined per building and will not be assumed across buildings. The asbestos survey will be performed in accordance with the USEPA's *Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials* (USEPA 560/5085-030a, October 1985). Please see Field Sampling Plan in Attachment B for more detailed sampling information.

The XRF sampling and analysis will also be conducted by identifying representative sampling areas. Representative sampling areas (RSAs) are painted surfaces that are similar in color and general appearance, and which appear to have been painted in the same time period. RSAs will be determined per building and will not be assumed across buildings. Daily logs will include instrument calibration, description of surfaces tested, XRF results, and estimated quantities. Please see Field Sampling Plan in Attachment B for more detailed sampling information. Paint chip samples will be collected as quality control samples. Quality control paint chip samples will be collected for every 30 XRF analyses. The paint chip samples will be analyzed by atomic absorption spectrophotometry (AAS). For budgeting purposes, EDI assumes the collection of two (2) quality control paint chip samples per building.

Residual product or dust or scrapings will be collected from building material surfaces that may include concrete, wood, brick or drywall. A sample of residual product or waste will be collected from each non-metal building component. The dust/ product will be collected as a wipe sample from 10 cm square and placed into a sample vial for laboratory analysis of lead. The lead analysis will include total and toxicity characteristic leaching procedure (TCLP) analysis. For budgeting purposes, EDI assumes the collection of five (5) samples per building for a total of

115 samples. Please see the Field Sampling Plan in Attachment B for more detailed sampling information.

Materials to be handled by a demolition contractor as universal waste will be visually surveyed to provide characterization and estimated quantities for demolition planning. Universal waste materials may include lighting ballasts that may contain PCBs, based on age of the ballasts; or lighting that may contain mercury. These materials will be identified for a contractor to verify or manage as part of demolition activities. Mercury will be screened in the office area, where mercury spill kits were observed, using a Lumex Mercury Analyzer.

QAPP Worksheet #11

Project Quality Objectives/Systematic Planning Process Statements

11.1 Who will use the data?

CH2M HILL will use this data to develop the remedial design. The USEPA will use the data to support the remedial design decisions made for the Superfund Site.

11.2 What will the data be used for?

The data will be used to prepare a remedial design for OU1 for the Eagle Zinc Superfund Site. The samples will be collected and analyzed onsite or submitted for laboratory analysis. The sample data and laboratory analysis will be evaluated for development of a preliminary design that will include evaluation of various demolition approaches for recycling and management of materials onsite; a project delivery schedule; specification outlines; preliminary drawings; value engineering screening.

11.3 What types of data are needed?

The sampling types, design, and rationale are discussed in Worksheet 10. The intent of the field investigation is to determine the best approach options for the building demolition and disposal of building materials. The building demolition waste will be investigated to identify RCRA Hazardous and nonhazardous waste streams in terms of recyclable material, offsite disposal, and onsite disposal.

11.4 How “good” should the data be in order to support the environmental decision?

The asbestos PLM sample analysis will meet standard quality assurance laboratory procedures. The sample analysis results will be reported as percent asbestos content, if asbestos fibers are present. Duplicate quality control samples will be submitted for every 10 HSAs, in other words, for every 30 asbestos samples collected, 1 sample will be a duplicate quality control sample. HSAs are sampled to the first positive.

The XRF analysis will read lead content in paint, and paint chip samples will be collected as a measure of quality control. One paint chip quality control sample will be collected for every 30 XRF analyses. The paint chip samples will be analyzed by AAS method following standard quality assurance laboratory procedures for lead content. The XRF instrument will be calibrated daily as a measure of quality control.

The dust/ product samples collected in glass sample containers or as wipe samples will be analyzed by EPA method 6010B for lead or other various metals. One duplicate sample per 20 samples will be collected for quality control.

11.5 How much data are needed? Where, when, and how should the data be collected/generated?

The number of samples and location of the samples can only be determined in the field during the field investigation after the visual survey. The data collection has been described in Worksheet 10 and in the Field Sampling Plan.

11.6 Who will collect and generate the data?

EDI's licensed inspectors will be onsite collecting the samples. The laboratory selected for analysis will generate the data. The asbestos samples will be submitted to IATL for asbestos analysis. The paint chip samples will be submitted to IATL for lead paint chip analysis. The residuals samples (wipe or solid) will be submitted through CLP for laboratory analysis of lead (total and TCLP), if CLP cannot perform the analysis, total and TCLP lead analysis can be performed by IATL on wipe and solid samples. The laboratory reports will be compiled into a field investigation report and this report will be used as part of the remedial design. The data will be archived as part of the remedial design work.

QAPP Worksheet #12
Measurement Performance Criteria

Matrix	Building materials				
Analytical Group¹	Asbestos				
Concentration Level	Low				
Sampling Procedure²	Analytical Method/SOP³	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
02030-Asbestos	PLM	Three samples collected per HSA, analyze to first positive	Positive for asbestos is 1% or greater	Duplicate sample collected (one every 10 HSAs)	S & A

¹If information varies within an analytical group, separate by individual analyte.

²Reference number from QAPP Worksheet #21 (see Section 3.1.2).

³Reference number from QAPP Worksheet #23 (see Section 3.2).

QAPP Worksheet #12
Measurement Performance Criteria

Matrix	Building materials				
Analytical Group¹	Lead in paint				
Concentration Level	Low				
Sampling Procedure²	Analytical Method/SOP³	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
02050-XRF sampling and direct read analysis	XRF	Three XRF readings per HSA	Positive for lead at equal to or greater than 1.0 mg/cm ²	Paint chip sample collected (one every 10 HSAs, focusing on confirmation of positive lead readings)	S & A

¹If information varies within an analytical group, separate by individual analyte.

²Reference number from QAPP Worksheet #21 (see Section 3.1.2).

³Reference number from QAPP Worksheet #23 (see Section 3.2).

Matrix	Residuals on Building materials				
Analytical Group¹	Lead in dust				
Concentration Level	High				
Sampling Procedure²	Analytical Method/SOP³	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
03030-Residual sampling	AAS / EPA SW846 6010	Precision	Positive for lead at 40ug/ft ²	Duplicate sample collected (one every 20 samples)	S & A

¹If information varies within an analytical group, separate by individual analyte.

²Reference number from QAPP Worksheet #21 (see Section 3.1.2).

³Reference number from QAPP Worksheet #23 (see Section 3.2).

QAPP Worksheet #13
Secondary Data Criteria and Limitations

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
IEPA XRF report from CH2M HILL	CH2M HILL has provided a report of XRF data dated 2009 as referenced in worksheet #10.	CH2M HILL	Limited data available. Assessment of building materials needed to determine characterization and disposal.	Limited data provided to date. Full plan with sample locations and laboratory reports needed to characterize hazardous and non- hazardous and plan for building demolition and material disposal.

QAPP Worksheet #14

Summary of Project Tasks

This worksheet provides a summary of project tasks as the outcome of project scoping activities. The following project tasks will be discussed:

- Site specific plans
- Subcontractor procurement and support activities
- Field investigation / data acquisition
- Sample handling, shipment, and analysis
- Reporting of field activities and contractor procured sample analysis

14.1 Site Specific Plans

In preparation for field activities, the following site specific plans will be prepared for USEPA approval. The Site Management Plan (SMP) addresses the planning and onsite field tasks and defines management responsibilities during the field tasks with respect to access, security, contingency procedures, utilities, and management of waste disposal from the sampling activities. The SMP is included as Attachment C

A Field Sampling Plan (FSP) is prepared and included to provide additional details regarding sampling, procedures, analytical methods, quality control samples and inclusive of standard operating procedures (SOPs) for sampling. The Field Sampling Plan is included as Attachment B.

Health and Safety of workers and the surrounding community is of grave importance for this project and all work performed by CH2M HILL and EDI team. A HSP is prepared to highlight onsite safety issues, inclusive of deteriorating buildings, uneven ground, and isolation of the site from the surrounding community. The HSP will specify safe procedures, emergency procedures, protective equipment, employee training, medical surveillance requirements, and planning appropriate for a healthy and safe work environment. The HSP is included as Attachment D.

14.2 Subcontractor Procurement and Support Activities

The laboratory, IATL, will be directly procured by CH2M HILL for sample analysis of asbestos content. Suspect asbestos building materials will be collected and submitted for Polarized Light Microscopy (PLM) laboratory analysis. This laboratory can also perform paint chip analysis by AAS and dust wipe samples for analysis of total lead and/or additional metals.

QAPP Worksheet #15

Reference Limits and Evaluation Table

Matrix: Building Materials

Analytical Group: See below

Concentration Level:

Analyte	CAS Number	Project Action Limit (applicable units)	Project Quantitation Limit (applicable units)	Analytical Method ¹		Achievable Laboratory Limits ²	
				MDLs	Method QLs	MDLs	QLs
Asbestos	1332-21-4	>1	% by weight	<0.25%	<0.25%	<0.25%	<0.25%
Lead (XRF analysis)	7439-92-1	1.0	Milligrams/ square cm	NA	NA	NA	NA
Total lead	7439-92-1	40	Micrograms/ square foot	<10ug/ft2	<10ug/ft2	<10ug/ft2	<10ug/ft2

¹Analytical MDLs and QLs are those documented in validated methods.

²Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

QAPP Worksheet #16
Project Schedule/Timeline

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field sampling/field support	EDI?CH2M HILL	07/14/2010	07/21/2010	Report	8/14/2010

QAPP Worksheet #17

Sampling Design and Rationale

This worksheet describes the field investigation activities planned for the OU1 to determine remedial design in terms of building demolition and onsite or offsite disposal of building demolition materials. The field activities will be conducted in accordance with the Remedial Design Work Plan, and the FSP as provided in Attachment B.

17.1 Describe and provide a rationale for choosing the sampling approach

The asbestos survey will be performed in accordance with USEPA Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials (USEPA 560/5085-030a, October 1985).

The lead survey will be performed in accordance with US HUD guidelines and USEPA standards, utilizing a modified and simplified sampling strategy combining lead testing with XRF equipment, paint chip sampling, dust sampling and lead risk assessment protocol, as per the Field Sampling Plan provided in Attachment B.

17.2 Sampling Design

The sampling design for building materials to sample, sample locations, descriptions are determined in the field and sampling matrices and numbers cannot be determined prior to the onsite visual survey.

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

See FSP – sampling locations will be determined in the field after visual assessment of HSAs.
SOPs are provided in the FSP.

QAPP Worksheet #19
Analytical SOP Requirements

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference¹	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Building material	asbestos	low	PLM/ EPA 600 R93-116		bag	none	NA
Paint Chip	lead	low	AAS / ASTM D3335		sample vial	none	NA
Lead dust or dust wipe	lead	low	AAS / EPASW846 6010 & 7420		sample vial	none	NA

¹Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #20
Field Quality Control Sample Summary

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference ¹	No. of Sampling Locations ²	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Building material	asbestos	low	Lab PLM	483	23		NA	NA		506
Paint chip	lead	low	Lab AAS These samples are QC check for XRF	46						46
Dust or dust wipe	lead	low	Lab AAS	110	5					115

¹Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

²If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.
Multiple layers of floor tile are analyzed separately and mastic is analyzed separately.

QAPP Worksheet #21
Project Sampling SOP References

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
02030 Asbestos	Asbestos Bulk Sampling	EDI	NA	N	
02050 XRF Analyzer	XRF Analyzer	EDI	XRF	N	
02070 Paint Chip	Paint chip collection for analysis of lead	EDI	NA	N	
03030 Residual	Residual Sampling	EDI	NA	N	

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field equipment will be provided by rental equipment supplier. All calibration activity will be documented upon receipt of rental equipment, and all field calibration will be performed in accordance with the manufacturer's specifications. At a minimum, field calibration of XRF equipment will include; calibration of equipment before first field test location; calibration at least every 4-hours during field use; and calibration after last field test location each day. Lumex Mercury Analyzer will be calibrated, tested, and operated in accordance with manufacturer instructions (an example SOP is provided in Attachment E).

Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EPA 600 / R-93/ 116	Asbestos (% by volume, % by weight)	Definitive	Asbestos	Polarized Light Microscope (40x-400x)	IATL, Inc.	N
AAS / EPASW846 /6010 & ASTM D3335	Lead in paint (% by weight, ppm) by AA - Flame	Definitive	Lead	AAS	IATL, Inc.	N
AAS / EPA SW 846/ 6010	Dust/wipe surface concentration of lead ($\mu\text{g}/\text{ft}^2$) by AA - Flame	Definitive	Lead	AAS	IATL, Inc.	N

Attachment F includes the SOPs provided by IATL for the analysis referenced above.

QAPP Worksheet #24
Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference¹
PLM	Cross Polars Kohler Illumination	Daily	Yes, No	None	Quality Manager	EPA 600 / R-93/ 116
AAS	Standards curve Blanks Matrix Spikes	Daily	Linear 80-120% 80-120%	None	Quality Manager	AAS / EPASW846 /6010 & ASTM D3335
AAS	Standards curve Blanks Matrix Spikes	Daily	Linear 80-120% 80-120%	None	Quality Manager	AAS / EPA SW 846/ 6010

¹Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
See Attachment F for laboratory provided methods and procedures.

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference ¹
PLM	Clean Optics, Replace Illumination	NA	Maintained By Manufacturer	Daily, Weekly, Monthly, Bi- Annual	NA	As needed	Quality Manager	EPA 600 / R- 93/ 116
AAS	Optics, supply gases, lamp/detector	Alignment, Flow, Hours	Maintained By Manufacturer	Daily, Weekly, Monthly, Bi- Annual	NA	As needed	Quality Manager	AAS / EPASW846 /6010 & ASTM D3335
AAS	Optics, supply gases, lamp/detector	Alignment, Flow, Hours	Maintained By Manufacturer	Daily, Weekly, Monthly, Bi- Annual	NA	As needed	Quality Manager	AAS / EPA SW 846/ 6010
PLM	Clean Optics, Replace Illumination	NA	Maintained By Manufacturer	Daily, Weekly, Monthly, Bi- Annual	NA	As needed	Quality Manager	EPA 600 / R- 93/ 116

¹Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #26 Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Site Supervisor or Lead Inspector/ EDI
Sample Packaging (Personnel/Organization): Site Supervisor or Lead Inspector/ EDI
Coordination of Shipment (Personnel/Organization): Sample Manager
Type of Shipment/Carrier: FedEx or equivalent overnight carrier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): IATL or appropriate contractor procured laboratory
Sample Custody and Storage (Personnel/Organization): IATL or appropriate contractor procured laboratory
Sample Preparation (Personnel/Organization): IATL or appropriate contractor procured laboratory
Sample Determinative Analysis (Personnel/Organization): Sample analysis will be conducted per the chain-of-custody records
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Determined by laboratory
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Determined by laboratory
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Handled by laboratory
Number of Days from Analysis: Handled by laboratory

QAPP Worksheet #27

Sample Custody Requirements

Proper sample handling, shipment, and maintenance of a chain of custody are key components of building the documentation and support for data that can be used to make project decisions. It is important that sample handling and sample chain-of-custody requirements be performed completely, accurately, and consistently.

27.1 Field Sample Custody Procedures

Field observations and other information pertinent to the collection of samples will be recorded in the field. Field data is recorded on sample log sheets and daily activities are recorded in field log books. Sample log sheets will record sample identification number (unique to each sample collected), brief material description, location, condition, and estimated quantity. Photographs of the sample activities and sampled materials will be taken as part of the field record.

27.2 Sample Labeling

All samples will be assigned a unique sample number. Each building will be assigned a number, which will be used in the sample number scheme. Numbers cannot be assigned until the visual survey is conducted to identify types and number of suspect ACM per building. Each sample will be labeled by number and date of collection (time of collection will be included on the chain of custody).

For samples being submitted to the UESPA CLP, EDI will follow chain-of-custody procedures in accordance with the requirements outlined in the *U. S. EPA Contract Laboratory Program Guidance for Field Samplers Draft Final April 2003*. EDI has been using this guidance document for all sampling field procedures related to USEPA work. EDI will continue to follow these guidelines and train all new staff personnel on these guidelines. EDI will use Forms II Lite to prepare sample chains of custody and tracking records. EDI will use custody seals on sample shipments per USEPA standard practices.

- The seals will be covered with clear tape to avoid accidental damage during shipment.
- The seal numbers will be documented on the chain-of-custody form.
- All sample shipment containers require seals.
- Labels for the sample tags are generated from the Forms II Lite program with one label affixed to the tag and one label affixed to the sample container.

Please see the Field Sampling Plan and SOPs for detailed information regarding sample labeling, chain of custody, and shipping and handling procedures.

QAPP Worksheet #28
QC Samples Table

The QC Samples are discussed in the FSP included as Attachment B. QC samples are also discussed in Worksheet 20.

QAPP Worksheet #29
Project Documents and Records

Sample Collection Documents and Records	Onsite Analysis Documents and Records	Offsite Analysis Documents and Records	Data Assessment Documents and Records	Other
Daily field notes, photographs and log sheets	Daily activities include field personnel, safety briefing, activities, instrument calibration, sample logging, management, and shipping preparation. Sample log sheets for XRF analysis will include positive or negative direct read for lead content.			
Laboratory analysis	Sample description and numbering records are generated onsite.	Laboratory analysis is generated offsite and submitted for evaluation and validation.		

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Building materials	Asbestos, lead paint	low	Will be generated during field activities	See worksheet #23	Data will be returned in 3-5 days from laboratory receipt of samples	International Asbestos Testing Laboratories (IATL) 9000 Commerce Parkway, Suite B Mt. Laurel, NJ 08054 Ray Sankey (raysankey@iatl.com) 877-428-4285	

QAPP Worksheet #31
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Asbestos & Lead			EDI	Jose Aguilera	CH2M HILL	CH2M HILL	CH2M HILL

Attachment A
HAZWOPER Certifications

Certificate of Completion

This certifies that

Patricia Feeley

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does not necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)

And all State OSHA and EPA Regulations As Well

Julius P. Griggs

Julius P. Griggs
Instructor #892

100416520518

Certificate Number

4/16/2010

Issue Date



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Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

Certificate of Training

This certifies that
Patricia A. Feeley

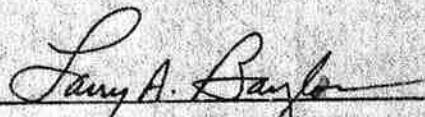
has received FORTY hours of training for attending the
OSHA HAZARDOUS WASTE SITE WORKER
OSHA 29 CFR 1910.120

August 2-5, 1993

Itasca, Illinois

Certificate Number 93-2535

SSN: 335-68-6860



Larry A. Baylor, President
Environmental Training Consultants, Inc.
1050 Granville, Itasca, Illinois 60143 (708) 773-2833

"Solving Environmental Concerns Through Training"

CEU: 5.0



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Paul Kybartas

has successfully completed the 8 hour Hazardous Waste Site Refresher course and has passed the competency exam in accordance with OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

Hazardous Materials Refresher

Course Date: January 11, 2008
Expiration Date: January 11, 2009

Exam Date: January 11, 2008
Certificate: HMR0801110095


Kathy Nicholson, Director

2008



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Paul Kybartas

has successfully completed the 40 hour Hazardous Waste Site Worker course and has passed the competency exam in accordance with OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response. This does not include field training.

Hazardous Waste Site Worker

Course Date: April 10-13, 2006

Expiration Date: April 13, 2007

Exam Date: April 13, 2006

Certificate: HW0604131005


Kathy Nicholson, Director

2006



This Certifies That

KRISTIN TEMPLIN

Has Completed the

8-Hour HAZWOPER Refresher Training Course

In accordance with 29 CFR 1910.120(e)(8) completed on 02/25/2010 in Paducah, KY

A handwritten signature in black ink, appearing to read "Owen B. Douglass, Jr.", with a stylized flourish at the end.

TRAINING MANAGER

Owen B. Douglass, Jr., PhD, CIH

A handwritten signature in black ink, appearing to read "Ted Deecke", with a stylized flourish at the end.

INSTRUCTOR

Theodore Deecke

1_16209_02252010

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

Blue Water Technologies LLC

CERTIFICATE OF TRAINING

THIS IS TO CERTIFY THAT

KRISTEN TEMPLIN

HAS SUCCESSFULLY COMPLETED

A COURSE IN

**HAZARDOUS WASTE OPERATIONS AND EMERGENCY
RESPONSE (HAZWOPER)**

CONSISTING OF 40 HOURS OF INSTRUCTION

AS REQUIRED BY 29 CFR 1910.120

September 30, 2005

Cynthia I. Frantz *Cynthia I. Frantz CHMM*
TECHNICAL SERVICES DIRECTOR

CERTIFICATE OF ACHIEVEMENT ASBESTOS ABATEMENT

Approved by the Illinois Department of Public Health and Indiana Department of Environmental Management

This is to certify that JOSE G. AGUILERA SSN# 454-57-7616
has completed the Contractor/Supervisor Initial Asbestos Training course and successfully passed the
examination on 10/26/2001 with a minimum score of 70% or better. Training was in accordance
with U.S. E.P.A. 40 CFR 763 Subpart E, Appendix C, Asbestos Containing Materials in Schools:
Model Accreditation Plan, TSCA II, Authorized by both AHERA & ASHARA.

10/22/2001-10/26/2001

Course Dates:

10/26/2002

Expires:

0110CS02

Certificate Number:



N. Penoff

Phone Number: (312) 421-7397

Director of Training

Nicholas J. Penoff

Doctor of Public Health

FORM # A-007

Attachment B
Field Sampling Plan

Field Sampling Plan - DRAFT

**Eagle Zinc Superfund Site
OU1 – Building Demolition
Hillsboro, Illinois**

June 2010

**Prepared for:
USEPA, Region 5
77 W. Jackson Blvd.
Chicago, IL 606**

**Prepared by:
Environmental Design International inc.
33 W. Monroe, Suite 1825
Chicago, Illinois 60603
312-245-1400 ext. 136**

**Submitted by: Patricia Feeley, P.G.
Project Manager for EDI**

**Reviewed by: Jose Aguilera
EDI Site Supervisor**

**Approved by: Gary Flentge, MPH, LEHP, REA
EDI Quality Assurance Officer (QAO)**



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Figure 1: Site Layout of Survey

Appendix A: Licenses and Certificates

Appendix B: 02030 Asbestos Bulk Sampling SOPs

Appendix C: 02050 XRF Analyzer and 02070 Paint Chip Collection for Analysis of Lead SOPs

Appendix D: 03030 Residual Sampling SOPs

1.0 INTRODUCTION

1.1 Scope and Location

This Field Sampling Plan (FSP) defines the scope of activities, sampling and analysis plan, and standard sampling procedures for completing the Field Investigation for the remedial design analysis of Operable Unit (OU) 1 of the Eagle Zinc Site in Hillsboro, Illinois. The field investigation will include a building survey of asbestos containing materials (ACM), lead-based paint (LBP), and residuals on building components.

1.2 Project Background

The site is located in a mixed industrial/commercial/residential area in Hillsboro, Montgomery County, Illinois. The site is approximately 132 acres with about 30 acres of buildings and associated structures. There are about 23 buildings onsite that were previously used for facility operations; the types of buildings include offices laboratories, manufacturing/processing, equipment/raw material/finished product storage, bag houses, and maintenance facilities. Also located on site are railroad spurs, residual material, two stormwater retention ponds, a small pond, and several roads. Active industrial operations ceased in 2003. The area has been zoned commercial/industrial and there are no plans to rezone the area for other uses.

Previous investigations have taken place since the early 1980s. The initial Remedial Investigation started in 2001 and a draft Remedial Investigation Report was produced in 2005. The previous investigations show multiple residue piles throughout the site that exceed screening levels. The contaminants of concern onsite include lead and cadmium. Other contaminants onsite include copper, zinc, and manganese. In 2008, the buildings and associated structures on site were sampled via X-Ray Fluorescence (XRF) and revealed significantly high levels of lead concentrations in, on, and around the building structures. This sampling event led to the USEPA decision to complete an interim action to address the immediate threat posed by the buildings. A removal action was conducted in January 2009 to quickly mitigate site access and exposure; the action consisted of fence installation around the most accessible areas of the site.

The USEPA has divided the site into two OUs to effectively deal with the short-term risks, building demolition, and the long-term risks, contaminated soil and groundwater onsite. OU-1 building demolition is the focus of this remedial design.

The selected remedy for OU1 consists of the following components:

- Building demolition – All buildings and associated above ground structures onsite will be removed via controlled demolition.

- Asbestos containing material (ACM) and hazardous materials survey and disposal – ACM and hazardous materials survey for disposal will be conducted and include universal wastes, PCB-containing devices, and LBP coated materials. ACM, universal wastes, and PCB-containing devices will be properly removed and disposed of offsite. LBP-coated debris will be evaluated for proper disposition. For example, LBP on metal will not be removed but recycled in total as scrap metal.
- Recycling – Salvageable material will be recycled or reused. Proceeds from recycling will be used to off-set the cost of the remedy.
- Disposal – Putrescible wastes or unsalvageable materials will be characterized and properly disposed of offsite.
- Onsite consolidation – Remaining debris will be consolidated and placed in the southwest corner of the site.
- Soil cover – A 1-foot soil cover will be placed as a barrier over the contaminated building debris consolidated onsite.

2.0 SAMPLING AND ANALYSIS PLAN

This FSP will discuss the project organization, personnel responsibilities, safety, sampling tasks, quality control, and reporting. Figure 1 shows the site location map and Figure 1 shows the site layout for survey. Buildings A-P will be surveyed for asbestos, lead in paint, lead residuals on building surfaces for planning of demolition. Universal wastes will be visually observed and estimated for quantity for demolition planning purposes. A direct read mercury instrument (Lumex Mercury Analyzer) will be used to assess mercury in the office building, but no sampling for mercury will be conducted.

2.1 Project Organization and Responsibilities

The project communication, organization, and responsibilities is outlined in Worksheets 6 and 7 of the Quality Assurance Project Plan (QAPP). The Project Manager (PM) for EDI – Patricia Feeley, P.G. will oversee the tasks and provide communication to CH2M HILL. The PM will prepare the planning documents, including the FSP with appropriate assistance and cooperation from team members. The PM will review all deliverables to CH2M HILL, provide progress reporting, draft and final deliverables.

Site Supervisor/ Asbestos Inspector (Jose Aguilera) will setup the field work, mobilize the field team, conduct the asbestos visual survey, and conduct the asbestos sampling and manage other sampling in accordance with the QAPP, FSP, and HSP. He will be responsible for the field schedule, the quality of work completed, organization of the samples for submission to the laboratory for analysis, daily tracking of progress and work completed. The Site Supervisor is a licensed asbestos inspector in Illinois. Inspector licenses are provided in Appendix A for review.

The Lead Inspector (Paul Kybartas) will setup for the XRF sampling, conduct the visual survey for painted surfaces for sampling, calibrate and run the XRF equipment for the analysis of representative sampling areas in accordance with the QAPP, FSP, and HSP. He will be responsible for daily field activity logs, XRF sample logs, and collection of QC paint chip samples. He will manage the lead-based paint survey and sampling schedule, quality of work completed, sample organization for submission to the laboratory, and reporting to the Site Supervisor. The Lead Inspector is a licensed risk assessor in Illinois.

The Field Technician (Kristen Templin) will assist with the sampling activities and perform duties as directed by the Site Supervisor, Asbestos Inspector, or Lead Inspector.

The Site Safety Officer and Sample Manager (Kristen Templin) will have the role of on site safety and sample management. Sample management will focus on sample submission to the USEPA Contract Laboratory Program (CLP) using Forms2Lite. Asbestos and lead samples will be managed by the Site Supervisor and the Lead

Inspector, but chains of custody will be collected and recorded by the Sample Manager. The Site Safety officer will conduct safety briefing meetings (at start of each day or as needed), and coordinate with CH2M HILL for access to the buildings.

The QAO, Gary Flentge, will provide quality control for the samples collected by reviewing chains of custody, field notes, and documentation as part of report review documentation. The laboratory results will be reviewed by the QAO and the Project Manager and prepared in a tabular format. The report of the field activities, sample results, conclusions, drawings, and supporting documentation will be reviewed by the QAO as prepared by the Site Supervisor and reviewed by the Project Manager.

2.2 Safety

The onsite buildings have been vacant for several years and are in various states of disrepair. The field team will survey each building for safety prior to entering. The asbestos survey of building materials may require demolition of walls or floor coverings to sample piping wrap behind walls or sample underlying layers of floor tile. EDI will follow the site specific HSP, which includes the hazard analysis form.

Safety will be further addressed in the HSP; however, a modified level D will be the personal protective equipment level for field personnel during visual survey activities and lead sampling. Modified level D will consist of work boots, safety glasses, hard hats, reflective safety vest, and latex gloves. Level C personal protective equipment will be used for asbestos sampling, inclusive of a half or full face mask air purifying respirator. The respirator will have HEPA filters. Tyvek suits may be used for sampling activities.

Sampling is expected to be conducted from the ground or from a lift to access materials that are out of reach, such as ceilings and roof materials.

2.3 Asbestos Survey

The EDI Site Supervisor (licensed inspector) will perform a visual inspection of each building, including exterior and interior walls, flooring and mastic, ceiling, insulated pipe covering, boiler insulation, generator insulation, wiring insulation, and roofing material to identify suspect ACM. A minimum of three bulk samples per Homogenous Sampling Area (HSA) of suspect ACM will be collected. HSAs are materials that are similar in color, texture, and general appearance, and which appear to have been installed in the same time period. The asbestos survey will be performed in accordance with the United States Environmental Protection Agency (USEPA) *Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials* (USEPA 560/5085-030a, October 1985). EDI's standard operating procedures (SOPs) for asbestos sampling are provided in Appendix B.

Bulk asbestos samples will be collected using wet sampling methods and a coring device or sample cutter, as appropriate, to collect a cross-section of the suspect material. Sample

collection materials will be decontaminated by wiping with wet wipes and dried by disposable paper towels to avoid cross contamination.

Each individual bulk ACM sample will be placed into a clean unused plastic sealable bag or container and marked with a unique sample identification number (for example, #505-31). For each sample, the identification number, brief material description including type (thermal system insulation (TSI), surfacing, miscellaneous), location, condition, and estimated quantity of ACM will be recorded on a bulk sample log sheet.

Chain-of-custody procedures will be followed for the survey. These procedures provide a written tracking mechanism that lists the person responsible for the sample from collection to delivery to the laboratory. Sample identification numbers, sample locations, and material descriptions are recorded on the chain-of-custody forms. The samples will be submitted to IATL laboratory (NVLAP #101165-0).

If floor tile results are found to contain 1 percent or less asbestos by polarized Light Microscopy (PLM), Transmission Electron Microscopy (TEM) may be required for a more definitive analysis of these materials for asbestos fiber content. PLM and TEM samples will be analyzed by a laboratory accredited through the National Voluntary Laboratory Accreditation Program (NAVLAP). EDI has budgeted 506 PLM samples and two TEM samples. Additional sampling due to additional HSAs may require additional costs. Standard sampling procedures are attached in Appendix B.

2.4 Lead Survey

The EDI Lead Inspector will perform a visual inspection of each building, including exterior and interior walls, floors, ceilings, etc., to identify suspect lead-based paints and coatings. Illinois Department of Public Health (IDPH) and EPA regulations define lead-based paint as paint or any surface coating containing greater 1.0 milligrams lead per square centimeter (mg/cm^2) or greater using an XRF analyzer. For XRF testing purposes, the building will be divided into room equivalents and building components will be identified within each room to identify painted surfaces to analyze. Painted surfaces will be classified into homogeneous (or representative) areas and EDI will collect at least three readings from each of the homogeneous areas on the accessible surfaces of the building components. EDI's SOPs for XRF sampling are included as Appendix C.

The XRF analyzer is a nonintrusive and direct read instrument. The XRF has a computer component that stores the data for each reading. For each reading, the identification number, brief material description, location, condition, and estimated quantity of painted surface will be recorded on a log sheet. The XRF is calibrated each morning according to the manufacturer's instructions. A calibration check on a known material is conducted at the start and end of each shift. The paint chip sample for every 10 HSAs will be collected as a measure of quality control. For budgeting purposes, EDI has estimated 46 paint chip

samples. The paint chip samples will be analyzed by an accredited laboratory using atomic absorption spectrophotometry.

The survey will focus on nonmetal building materials that will be removed as part of demolition and will be recycled or handled onsite. Sampling to determine hazardous characteristics is required to determine best practices for the recycling of the material or the disposal of the material, and procedures for sampling will be included in the remedial design and demolition work plan (under development by CH2M HILL).

2.5 Residuals

The buildings have residual product, waste and/or dust throughout the interior and exterior of the buildings. A sample of residual product or waste may be collected from each nonmetal building component, if the dust/dirt appears to be more than 1 centimeter (cm) thick. The dust/dirt in a 10 cm square will be collected into a glass sample container for CLP laboratory analysis of total and TCLP metals (lead, zinc, cadmium). If the dust/dirt is less than 1 cm thick, a wipe sample will be collected from a 10 cm square for laboratory analysis of total and TCLP metals (lead, zinc, cadmium). EDI estimates 5 samples collected per building as dust/dirt or wipe for 115 samples total. This estimate includes five samples as duplicates that will be analyzed for quality control. A duplicate sample will be collected immediately adjacent (adjacent 10 cm square) to the sample collected. EDI will follow CLP Forms II Lite sample logging and tracking as the chain of custody. Attached in Appendix D are the sampling SOPs for residuals, wipes, and sample handling.

2.6 Decontamination and Demobilization

All equipment involved in field sampling activities will be decontaminated before and after sampling and prior to leaving the site. Decontamination of sampling equipment will be conducted as follows:

- Wipe cutting knife or blades used for asbestos sample collection or paint chip sample collection with a disinfecting wipe
- Spray water rinse of sample collection device (knife blade, cutting device)
- Wash with Trisodium phosphate wash (Alconox)
- Rinse small items with distilled water and rinse large items with potable water
- Air dry or pat dry with paper towels for small items

Equipment that cannot feasibly be decontaminated by hand such as the lift or car tires, may require car wash cleaning as part of demobilization.

Personnel decontamination will follow procedures contained in site-specific health and safety plans (HSP). Decontamination procedures may be altered to address site-specific conditions.

Demobilization activities will include decontamination of equipment being removed from the site as EDI owned equipment (vehicles, ladders, etc) or as rented equipment from a third party (boom lift). CH2M HILL will assist with decontamination labor. CH2M HILL will provide site access and security for the site. CH2M HILL will close the site at the end of the field investigation.

2.7 Quality Control

For both the asbestos and lead surveys, duplicate samples will be collected for 10 percent of the overall HSAs collected. In other words for every 10 homogenous areas, 30 samples will be collected, and 1 duplicate sample will be collected. A duplicate sample for asbestos will consist of cutting a larger sample piece from the pipe wrap or ceiling tile, dividing the bulk sample in two; one represents the sample and one represents the duplicate. Duplicates will be used as a quality assurance / quality control (QA/QC) validation of the laboratory data, and results that are not consistent with the sample will be rechecked by the laboratory. A duplicate sample for lead will be a paint chip sample that is collected, placed in a sealable container and submitted under chain-of-custody procedures to a laboratory for analysis of lead by weight (using method atomic absorption spectrophotometry). The Site Supervisor will compare the log sheets and chains of custody daily for discrepancies. Any discrepancies will be addressed in the field for correction as soon as possible.

Reporting QA will be conducted by the QAO after reviewing laboratory data, tables of data, field notes, and drawings.

2.8 Reporting

The Field Investigation Report will include an introduction, site description, methodology, sample results, and conclusions with figures, tables, laboratory data report, photographs, and inspector licenses and laboratory licenses. The report will have a section discussing abatement for asbestos and lead materials (and other contaminants on recyclable building products), estimated quantities of materials to be abated, and a cost estimate for discussion purposes. The report will be prepared by the Site Supervisor, reviewed by the QAO and by the Project Manager.

3.0 SCHEDULE


EDI is scheduling the field work to be completed in 1 week, the work will be scheduled shortly after approval by USEPA and is expected to begin in July or August 2010. EDI will mobilize on a Monday and arrange access, view the buildings, and begin visual surveys. A site safety meeting will be conducted onsite prior to work being conducted. Visual inspections will be conducted and asbestos sampling will begin after the visual inspection of the building and material is complete. XRF lead analysis will begin after site setup and is expected to take approximately 3-4 days. Samples will be submitted for the laboratory analysis after completion of the survey. Laboratory analytical results for PLM will be provided on a 3-5 day turn-around time. EDI will provide preliminary verbal information within 1 week of completion of field activities, per CH2M HILL requests. The draft Field Investigation Report will be available 4 to 5 weeks after the field work is completed.

4.0 STANDARD SAMPLING PROCEDURES

The QAPP will discuss the data quality objectives for this project, the measurement of the quality objectives, general sampling documentation procedures for tracking samples using chains of custody for sample submittal, quality control samples, auditing for nonconformance, and application of corrective action to document and revise procedures to meet the quality objectives.

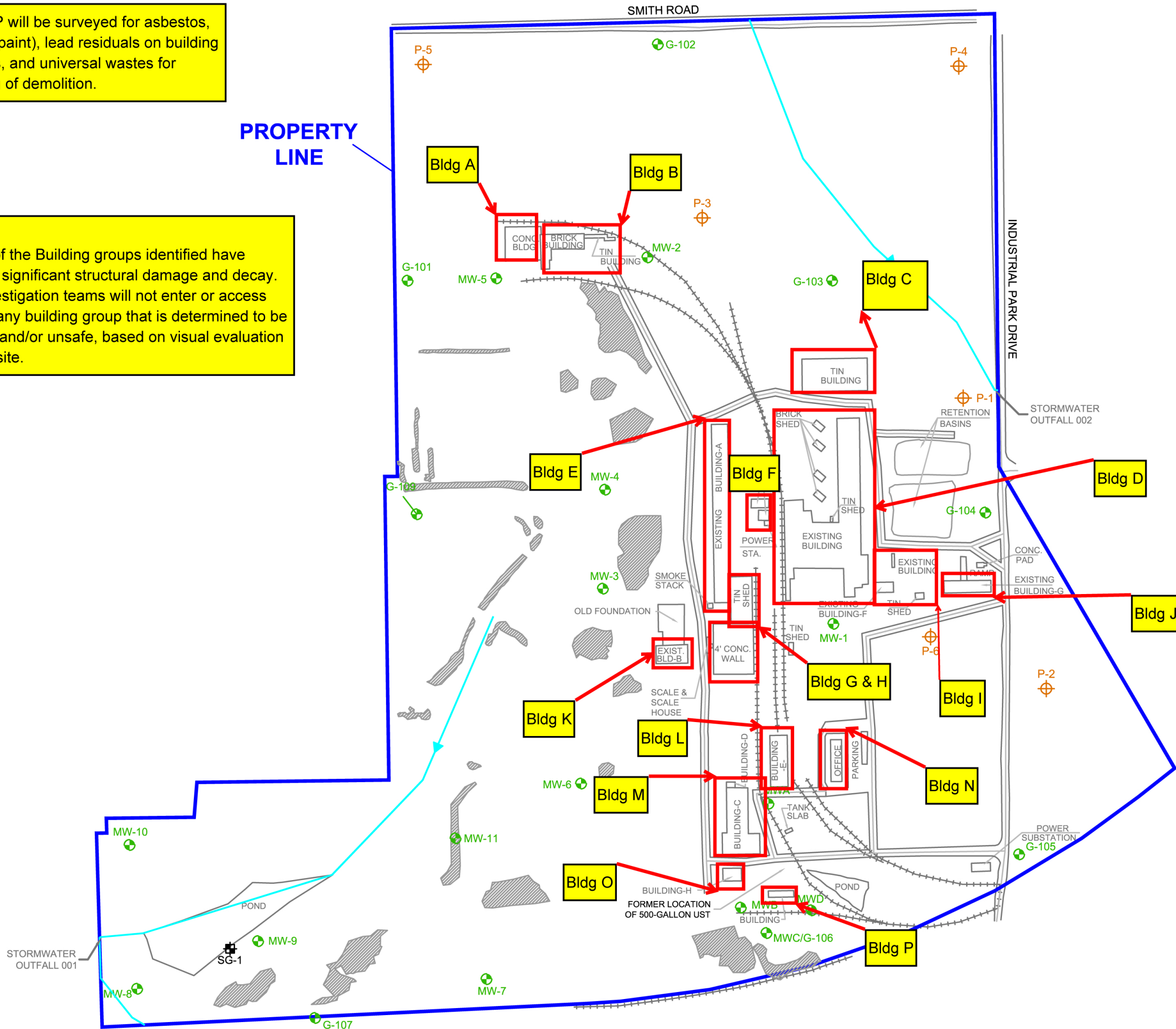
Figure

Figure 2: Site Layout for Survey
Field Sampling Plan
(Base drawing provided by CH2M Hill)

 Bldg A-P will be surveyed for asbestos, lead (in paint), lead residuals on building surfaces, and universal wastes for planning of demolition.

NOTE:
Several of the Building groups identified have limited to significant structural damage and decay. Field investigation teams will not enter or access areas of any building group that is determined to be unsound and/or unsafe, based on visual evaluation once on-site.

**PROPERTY
LINE**



LEGEND

- MONITORING WELL
- PIEZOMETER
- STAFF GAUGE
- STREAMS/DRAINAGEWAYS
- STORM WATER/SURFACE WATER FLOW
- RESIDUE PILES

APPROX. SCALE (ft.)

0 360

Figure 1

SITE LAYOUT MAP EAGLE ZINC HILLSBORO, ILLINOIS

DATE:	CONTRACT NUMBER:		FIGURE
DRAFTER:	APPROVED:	REVISED:	

Appendix A
Licenses and Certifications



**ASBESTOS
PROFESSIONAL
LICENSE**

ID NUMBER
100 - 10088

ISSUED
4/26/2010

EXPIRES
05/15/2011

JOSE G AGUILERA
2652 S. CENTRAL PARK AVEN
CHICAGO, IL 60623

Environmental Health



ENDORSEMENTS

TC EXPIRES

INSPECTOR

2/5/2011

PROJECT MANAGER
AIR SAMPLING PROFESSIONAL

7/31/2010

Alteration of this license shall result in legal action
This license issued under authority of the State of Illinois
Department of Public Health
This license is valid only when accompanied by a valid
training course certificate.



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Jose Aguilera

has successfully completed the 4 hour Asbestos Building Inspector Refresher course and has passed the competency exam with a minimum score of 70%. This course is accredited by the Illinois Department of Public Health and the Indiana Department of Environmental Management for purposes of accreditation in accordance with EPA 40 CFR 763, Asbestos Hazard Emergency Response Act (AHERA) and TSCA Title II.

Asbestos Building Inspector Refresher

Course Date: 2/5/2010
Expiration Date: 2/5/2011

Exam Date: 2/5/2010
Certificate: BIR1002050274


Kathy DeSalvo, Director

2010



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Jose G. Aguilera

has successfully completed the 16 hour Lead Risk Assessor course and has passed the competency exam with a minimum score of 70%. This course is accredited by the Illinois Department of Public Health in accordance with the Illinois Lead Poisoning Prevention Code.

Lead Risk Assessor

Course Date: 4/2-3/2009
Expiration Date: 4/3/2012

Exam Date: 4/3/2009
Certificate: LRA0904021069

Kathy DeSalvo Director

2009



**LEAD RISK
ASSESSOR LICENSE**

LEAD ID	ISSUED	EXPIRES
006379	1/27/2010	1/31/2011

Paul S Kybartas
7663 Walnut Ave.
Woodridge, IL 60517



ILLINOIS LEAD PROGRAM
Environmental Health

Alteration of this license shall result in legal action
RISK ASSESSOR CERTIFICATE EXPIRES
2/1/2011

This license issued under authority of the State
of Illinois -Department of Public Health

This license is valid only when accompanied by
a valid training course certificate

If found return to 525 W. Jefferson St Springfield, IL 62761



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Paul Kybartas

has successfully completed the 8 hour Lead Risk Assessor Refresher course and has passed the competency exam with a minimum score of 70%. This course is accredited by the Illinois Department of Public Health in accordance with the Illinois Lead Poisoning Prevention Code.

Lead Risk Assessor Refresher

Course Date: February 1, 2008
Expiration Date: February 1, 2011

Exam Date: February 1, 2008
Certificate: LRAR0802010365

Kathy DeSalvo, Director

2008

Certificate of Achievement

This is to certify that

Paul S. Kybartas
Aires Consulting Group

on the 31st day of July 2008 successfully completed the factory training for

RMD's LPA-1 Lead Paint Inspection System

including, but not limited to the topics of Radiation Safety, DOT Regulations, and the Proper Use of the Instrument.



Jacob Paster, Vice President, RMD
44 Hunt St., Watertown, Massachusetts





**ASBESTOS
PROFESSIONAL
LICENSE**

ID NUMBER
100 - 08451

ISSUED
5/4/2010

EXPIRES
05/15/2011

PAUL S KYBARTAS
7663 WALNUT AVENUE
WOODRIDGE, IL 60517
Environmental Health



ENDORSEMENTS

TC EXPIRES

INSPECTOR

3/24/2011

PROJECT MANAGER
AIR SAMPLING PROFESSIONAL

1/23/2011

Alteration of this license shall result in legal action
This license issued under authority of the State of Illinois
Department of Public Health
This license is valid only when accompanied by a valid
training course certificate.



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Paul Kybartas

has successfully completed the 4 hour Asbestos Building Inspector Refresher course and has passed the competency exam with a minimum score of 70%. This course is accredited by the Illinois Department of Public Health and the Indiana Department of Environmental Management for purposes of accreditation in accordance with EPA 40 CFR 763, Asbestos Hazard Emergency Response Act (AHERA) and TSCA Title II.

Asbestos Building Inspector Refresher

Course Date: 3/24/2010
Expiration Date: 3/24/2011

Exam Date: 3/24/2010
Certificate: BIR1003240903


Kathy DeSalvo, Director

2010



Occupational Training & Supply, Inc.

7233 Adams Street ♦ Willowbrook, IL 60527 ♦ (630) 655-3900

Kristen Templin

has successfully completed the 24 hour Asbestos Building Inspector course and has passed the competency exam with a minimum score of 70%. This course is accredited by the Illinois Department of Public Health and Indiana Department Environmental Management for purposes of accreditation in accordance with EPA 40 CFR 763, Asbestos Hazard Emergency Response Act (AHERA) and TSCA Title II.

Asbestos Building Inspector

Course Date: 3/3-5/2010

Expiration Date: 3/5/2011

Exam Date: 3/5/2010

Certificate: ABI1003050627


Kathy DeSalvo / Director

2010



**ASBESTOS
PROFESSIONAL
LICENSE**

ID NUMBER
100 - 18364

ISSUED
2/19/2010

EXPIRES
05/15/2011

KRISTEN R TEMPLIN
3933 N CLARENDON APT 505
CHICAGO, IL 60613

Environmental Health



ENDORSEMENTS

TC EXPIRES

PROJECT MANAGER

8/21/2010

Alteration of this license shall result in legal action
This license issued under authority of the State of Illinois
Department of Public Health
This license is valid only when accompanied by a valid
training course certificate.

Appendix B
02030 Asbestos Bulk Sampling SOPs

Asbestos Bulk Sampling

Standard Operating Procedure

Section 02030

Revised June 2010



Environmental Design International inc.

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Asbestos Bulk Sampling

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Asbestos Bulk Sampling and Chain of Custody

1.0 Introduction

The objective of this document is to provide procedures for collection of representative asbestos bulk samples. The procedures presented are not intended to address site-specific conditions. The intent is to verify that samples are representative of the particular building material (all layers) being sampled and meet the objectives of the overall sampling program.

2.0 Equipment

2.1 Preparation

Prior to mobilization to the field the following equipment checks will be performed:

- Verify that all equipment required is available and functioning properly. Acquire additional supplies, if necessary.
- Review Health and Safety Plan (HSP) and Sampling Plan, if available.
- Charge any batteries necessary to power field equipment.
- Verify that the appropriate type and number of sample containers required have been obtained.
- Identify nearest location and hours for overnight carrier, if necessary, for sample shipment to laboratory.

2.2 Equipment Checklist

The following equipment list is to be used as a guide for assembling the necessary equipment prior to mobilization. Site-specific requirements will determine the exact equipment needs.

- | | |
|---------------------------------------|--|
| • Field logbook and sample log sheets | • Wet disinfecting wipes |
| • Sampling Plan, if available | • Paper towels |
| • Sample location map | • Spray paint |
| • Tape measure | • Digital camera |
| • Tool box to include at a minimum: | • Sampling devices |
| – screwdriver | • Sharpie and/or other writing equipment |
| – pliers | • Paper towels |
| – hacksaw | • Appropriate health and safety |
| – hammer | protective equipment (latex gloves) |
| – adjustable wrench | • Trash bags |
| – flashlight | |
| • Respiratory protection | |

- Sealable plastic bags
- Sample labels
- Chain-of-custody forms and seals
- Shipping packages
- Packing material
- Overnight carrier forms

3.0 Field Documentation

Field measurements including sampling locations, sample number, and sample descriptions (color, consistency, thickness) will be documented in the field logbook or on designated field log sheets. Entries in the logbook (or on log sheets) will be made with waterproof ink and will include (please refer to Field Activity Logbook Section 01010), as a minimum:

- Date, time, and personnel present
- Documentation of existing weather conditions
- Field measurements (i.e., sample depth)
- Unusual events
- Sample location and number
- Sample description
- General chronological description of field activities
- Visitors onsite
- Changes to plans or specifications

4.0 Sample Handling

4.1 Sample Identification and Labeling

All samples collected are to be adequately marked for identification from the time of collection and packaging through shipping. Marking will be by means of a label attached to the sample container or directly placed on the sample bag. Sample identification will include the sample number. Other information will be provided on the chain-of-custody forms, as appropriate:

- Project name and number
- Sample type
- Sample location(nomenclature)
- Sampling date and time
- Requested analysis
- Sampler's initials, unless using project specific format (i.e., forms II Lite)

Sample labels are to be completed for each sample using waterproof ink affixed to the sample container, not the lid.

4.2 Sample Containers and Preservation

Samples should be collected in appropriate sized plastic bags, so the sample will not puncture the bag or damage the integrity of the sample collected.

4.3 Sample Packaging and Shipment

The following procedures will be used for sample management:

- Close bag securely.
- Check to make sure that the sample labeling has been completed with all appropriate information
- Put chain-of-custody forms with the bag of samples. If more than one group of samples is being shipped in the same container make sure to place the chain-of-custody form in a plastic bag with the associated samples.
- If shipping, affix airbill with shipper's and consignee's addresses on the top of the shipping container.

4.4 Sample Custody Procedures

Chain-of-custody forms will be prepared for each sample collected for laboratory analysis. The chain-of-custody form will be used to document sample possession from the time of collection to disposal. Each time custody of a sample changes, the new custodian will sign the form and document the time and date. A sample will be considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with the samples, after being in physical possession and/or
- In a secured area, restricted to authorized personnel

The following chain-of-custody procedures will be followed for all samples collected for laboratory analysis:

- A chain-of-custody record will be initiated in the field for each sample. A copy of this record will accompany the cooler of sample or sample group.
- The chain of custody will be a paper form provided by the laboratory or electronic Forms II Lite program as required by USEPA.
- Each time the responsibility for custody of the sample changes, the new custodian will sign the record and denote the date on the "Received By" box. When the sample changes custody again, the person will sign the "Relinquished By" box, and notes the date and time.

- If the samples are transported directly to the laboratory, the chain-of-custody record will remain with the samples.
- If commercial carrier ships the samples to the laboratory, the chain-of-custody record will be sealed in a shipping container with the samples. The shipping container will be sealed prior to relinquishing it to the carrier.
- For samples shipped by commercial carrier, the airbill will serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory.

5.0 Sampling Procedures

5.1 General Sampling Procedures

The Asbestos Bulk Sampling survey will be performed in accordance with the United States Environmental Protection Agency (USEPA) regulations and guidance documents, including *Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials* (USEPA 560/5085-030a, October 1985). The Asbestos Containing Material (ACM) survey will include the following activities:

- Conduct a visual inspection of accessible areas of the building
- Collect bulk samples of identified suspect ACM per homogeneous material in accessible areas of the building; Homogenous Sampling Areas (HSAs) are areas containing materials that are similar in color, texture, and general appearance, and which appear to have been uniformly installed during the same time period.
- Collect bulk samples of suspect ACM are collected using wet sampling methods with a coring device or a sample cutter, as appropriate, to collect a cross-section of the suspect ACM. All layers of each suspect material are to be sampled.
- Collect three (3) samples of each suspect material, from each homogenous area are to be collected, from different locations.
- Decontaminate sample collection tools are decontaminated after each sample to avoid cross contamination.
- Record bulk ACM samples are placed into clean unused sample containers marked with a unique sample identification number.
- Record for each sample, the identification number, brief material description, location, condition, and estimated quantity of suspect ACM are on a bulk sample log sheet.

To collect exterior composite soil samples for asbestos, use stainless steel instruments or other sampling collection equipment that can be properly decontaminated or disposed of after each sample collection. Samples should be collected as composite soil samples. The composite soil sample is collected from four locations along the drip line on the South, West, East, and North sides of the building. The composite soil sample is collected at approximately ½-inch depth. Asbestos soil samples are placed into clean unused bags or sample containers marked with a unique sample identification number. For each composite

sample, the identification number, brief material description, and locations of soil collected are recorded on a bulk sample log sheet.

Chain-of-custody procedures are followed for the ACM bulk sampling. These procedures provide a written tracking mechanism that lists the person responsible for the sample from collection to delivery to the laboratory. Sample identification numbers, sample locations, and material descriptions are recorded on the chain-of-custody forms.

Asbestos bulk samples are sent to an American Industrial Hygiene Association and National Voluntary Laboratory Accreditation Program accredited laboratory. Analysis of suspect ACM bulk samples are executed using polarized light microscopy (PLM). Samples are analyzed by polarized light microscopy (PLM) supplemented with dispersion staining. PLM is an USEPA-approved method that utilizes a light microscope equipped with polarized filters (USEPA Method 600/R-93/116). Generally, PLM will be used to view all three (3) HSA samples, or until a first positive result is rendered per homogeneous material.

Some materials may not be accurately identified and/or quantified by PLM. As an example, the original fabrication of vinyl floor tile routinely involved milling of asbestos fibers to extremely small sizes. As a result, these fibers may go undetected under the standard PLM method. In these cases, transmission electron microscopy (TEM) may be required for a more definitive analysis of these materials. These types of flooring materials that are reported by laboratory analysis to be non-asbestos by PLM analysis are routinely submitted to an accredited laboratory for analysis under TEM for verification of asbestos content.

5.2 Bulk Asbestos Sampling - Procedures

Note: Sample collection should be conducted either after working hours or when a building/area is not in use.

1. Conduct a preliminary walkthrough of the building that is to be inspected and produce an inventory of suspect and nonsuspect materials identified.
2. Group the suspect asbestos containing materials into “homogenous” sampling areas (HSA).
3. Use a diagram to show all suspect materials in the sampling areas for each HSA
4. The diagram should include:
 - a. Site location
 - b. Identification number
 - c. Description of sampling area
 - d. Areas dimensions and scale
 - e. Name of inspector
 - f. Date of inspection
5. Collect number of samples according to size of area:

<u>Type of Material</u>	<u>Minimum Number to Collect</u>
Miscellaneous	3
Thermal system insulation	3

For surfacing materials:

<u>Size of HSA</u>	<u>Minimum Number to Collect</u>
Less than 5,000 square feet	5
5,000 square feet. or greater	7

Steps for sampling surfacing material, thermal insulation and miscellaneous materials:

1. Spread a plastic drop cloth and set up other equipment, e.g., ladder.
2. Put on protective equipment (respirator and protective clothing, if needed).
3. Label bulk sample container with an identification number.
4. Place label on the container, not the lid to avoid mix up of samples during analysis.
5. Record sample information on Sampling Data Form (chain-of-custody form)
 - a. An identification number
 - b. Record number
 - c. Sample location
 - d. Type of material
6. Mark the sample location on the sampling diagram.
7. Record the sample identification number on the plan diagram.
8. Photograph bulk sample location site for project record.
9. Moisten area where sample is to be extracted (spray the immediate area with water).
10. Extract sample using a clean knife, cork borer, or other similar device to cut out or scrape off a small piece of the material (usually 1-10 grams). Penetrate all layers of material, and do not disturb adjacent materials.
11. Place sample in a container and seal tightly.
12. Wipe the exterior of the container with a wet wipe to remove any material that may have adhered to it during sampling.
13. Clean the tools with wet wipes and wet mop or vacuum area with a HEPA vacuum to clean all debris.
14. Fill the sample hole with caulking compound on a highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release) or for appearance. Do not leave exposed or disturbed materials uncovered.
15. Repeat the Steps 1-14 at each sample location.
16. Place sample containers in a plastic bag.
17. Label the accumulated samples bag.
 - a. Project number
 - b. Site name

18. Discard protective clothing, wet wipes and rags, cartridge filters, and drop cloth in a labeled disposal bag.
19. Seal and retain bag until lab results are received. If samples are positive for asbestos, dispose of bag as asbestos-contaminated waste. Disposal bag must be labeled properly and disposed in a state-approved landfill. Unless every sample tests negative for asbestos, discard waste as asbestos-containing material.

5.3 Composite Soil Sampling for Asbestos

Soil samples may be collected using a variety of methods and equipment depending on the sampling depth, the type of sample required (disturbed versus undisturbed), and the soil type. When selecting the appropriate sampling equipment care should be taken to ensure that the integrity of the sample is maintained and that the objectives of the sampling program are met. Sampling equipment must also be decontaminated prior to use at each location.

General sampling procedures include:

- Perform a general site survey prior to site entry.
- Identify and mark all sampling locations. Typically, samples will be collected from four locations along the drip line of a building that is being inspected at approximately ½- inch depth per each of four composite samples.
- Collect the appropriate number of samples as outlined in the Sampling Plan (at least one composite sample per side of building, if possible)
- Confirm that the correct sample volume has been collected for the required analysis.
- Record the time and date of sample collection, as well as a description of the sample in the field logbook.

Collection of near-surface soil samples can be accomplished with spades, shovels, and scoops. The surface material can be removed to the required depth with this equipment, then a stainless steel trowel can be used to collect the sample.

The procedure for collection of surface soil samples is as follows:

1. Using a decontaminated space, remove the top layer of soil to the desired sample depth.
2. Using a decontaminated stainless steel scoop or trowel, remove and discard a thin layer of soil from the area that came into contact with the spade.
3. Using the stainless steel scoop or trowel, transfer the sample directly to the sample containers.
4. Backfill the hole and replace with grass turf, if necessary.

Sample Handling Procedures

1. Ensure that samples collected are neither lost nor is their identity confused.
2. Determine a scheme for assigning sample identification numbers, prior to sample collection.
3. Attach a sample ID label to container, after placing a sample in the container.
4. Enter the ID number on the chain-of-custody sheet.
5. Mark the sample location on the building floor plan/diagram.
6. Place the sample in the plastic bag.
7. Place one copy of chain-of-custody sheet with the samples for shipping to laboratory.
8. Retain one copy of chain-of-custody sheet with field file for documentation purposes.
9. Ship or deliver samples to a testing laboratory.

6.0 Quality Assurance/Quality Control (QA/QC)

There are five primary areas of concern for QA/QC in the collection of representative samples:

1. Obtaining a sample representative of the HSA
2. Ensuring that the sampling devices are constructed of materials and utilized in a manner that will not interact with or alter the analyses
3. Ensuring that the results generated by these procedures are reproducible; therefore, the sample scheme may incorporate duplicate samples
4. Preventing cross-contamination. Sampling should proceed from the least affected area, if known
5. Ensuring that samples are properly packaged, and delivered or shipped

7.0 Decontamination

All equipment involved in field sampling activities will be decontaminated before and after sampling and prior to leaving the site. Decontamination of sampling equipment will be conducted as follows:

- Potable water rinse
- Trisodium phosphate wash, or applicable decontamination solution as appropriate
- Distilled water rinse
- Air dry or wipe with a clean paper towel

Equipment that cannot feasibly be decontaminated by hand such as augers, may require high-pressure steam cleaning prior to use. A temporary plastic liner will be constructed to collect all decontamination water generated during steam cleaning, if required.

Personnel decontamination will follow procedures contained in site-specific HSPs. Decontamination procedures may be altered to address site-specific conditions.

8.0 Health and Safety

Depending on the site-specific contaminants, various protective programs must be implemented prior to collecting the first asbestos sample. The site HSP should be reviewed with specific emphasis placed on the protection program planned for direct contact tasks. Standard safe operating practices should be followed, including minimization of contact with potential constituents in both the vapor phase and solid matrix through the use of respirators and protective clothing.

Depending on the type of constituent expected or determined in previous sampling efforts, the following safe work practices will be employed:

- Particulate or inorganic constituents
 - Avoid skin contact with and incidental ingestion of soils and dusts
 - Utilize protective gloves
 - Utilize protective respirators

Appendix C
02050 XRF Analyzer and 02070 Paint Chip
Collection for Analysis of Lead SOPs

X-Ray Fluorescence (XRF) Analyzer

Standard Operating Procedure

Section 02050

June 2010



Environmental Design International inc.

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X-Ray Fluorescence (XRF) Analyzer

1.0 Introduction

The objective of this document is to provide procedures for collection of representative data using a handheld x-ray fluorescence analyzer (XRF). The procedures presented are not intended to address site-specific conditions. The intent is to verify that data are representative of the particular areas being sampled and meet the objectives of the overall sampling program. The XRF measures content of lead in paint, soil or other materials.

2.0 Equipment

2.1 Preparation

Prior to mobilization to the field the following equipment checks will be performed:

- Verify that the XRF analyzer is available and functioning properly; complete any training necessary for the safe operation of the XRF analyzer; acquire additional supplies, if necessary.
- Exercise appropriate basic radiation safety principles, including the understanding and practice of time, distance, and shielding when using the XRF analyzer.
- Review Health and Safety Plan (HSP) and Sampling Plan, if available.
- Verify that factory calibrations on field screening equipment are current.
- Charge any batteries necessary to power field equipment.

2.2 Equipment Checklist

The following equipment list is to be used as a guide for assembling the necessary equipment prior to mobilization. Site-specific requirements will determine the exact equipment needs.

- | | |
|-------------------------------------|-------------------------------------|
| • Field logbook | • GPS handheld locator |
| • Field data sheets | • XRF analyzer |
| • Sampling Plan, if available | • Tool box to include at a minimum: |
| • Tape measure | – screwdriver |
| • Digital camera | – pliers |
| • Plastic sheeting | – hacksaw |
| • Appropriate health and safety | – hammer |
| protective equipment (latex gloves) | – adjustable wrench |
| • Trash bags | – flashlight |
| | • Sealable plastic bags |

3.0 Field Documentation

Field measurements including sampling locations and sample descriptions (color, layers) will be documented in the field logbook or on field log sheets. Entries in the logbook (or on log sheets) will be made with waterproof ink and will include, as a minimum:

- Date, time, and personnel present
- Documentation of existing weather conditions
- Field equipment calibration data
- Field measurements
- Unusual events
- Sample location and number
- Sample description
- General chronological description of field activities
- Visitors onsite
- Changes to plans or specifications

4.0 Sample Plan

A visual survey should be conducted to identify representative sampling areas to be analyzed by XRF. Each representative sampling area will have a minimum of three (3) locations tested with the XRF analyzer. Each XRF testing location will be described on a sample log sheet identifying the representative location, paint color, estimated quantity, and positive or negative XRF result.

5.0 Sampling Procedures

5.1 General Sampling Procedures

NOTE: Sampling with an XRF requires any person using the equipment be trained because the radioactive source within the equipment. Manufacturer guidelines should be followed for calibration procedures prior to any sampling.

General sampling procedures include:

- Perform a general site survey prior to site entry in accordance with the HSP..
- Identify all sampling locations, based on representative areas observed. Representative areas may be defined by similar paint colors
- Follow the manufacturer instructions on operation of the XRF machine for testing and analysis of representative sampling areas.
- Follow applicable Performance Characteristic Sheets for the XRF analyzer in use for the field survey.

- Record the time and date of sample collection, as well as a description of the sample in the field logbook or on sample log sheets.

5.2 XRF Soil Sampling

Similar procedures to identifying a representative sampling location should be followed when analyzing for metals in soil using an XRF. Only XRF analyzers manufactured and properly equipped with soil analyzing apparatus can be used for soil analysis. All soil analysis by XRF shall be performed in accordance with applicable manufacturer specifications, guidelines and directions. All XRF equipment must be protected from potential contamination from direct contact with soil.

6.0 Quality Assurance/Quality Control (QA/QC)

There are six primary areas of concern for QA/QC in the collection of representative samples:

1. Obtaining a representative sample area for analysis
2. Ensuring that the sampling devices are constructed of materials and utilized in a manner that will not interact with or alter the analyses
3. Ensuring that the results generated by these procedures are reproducible; therefore, the sample scheme may incorporate duplicate samples
4. Preventing cross-contamination. Sampling should proceed from the least affected area, if known.
5. Calibrating equipment for obtaining field measurements

6.1 QA/QC Samples

QA/QC sample requirements will be evaluated on a site-specific basis and will include multiple readings of no fewer than three (3) XRF analyzer readings of a representative sample area, and may include paint chip samples that will be submitted for laboratory analysis.

Paint chip samples of suspect lead paints and coatings will be submitted for laboratory analysis and will be used to confirm and support the XRF analyzer results. Field duplicates are designed to assess sampling and analytical reproducibility.

6.2 Calibration Procedures

Field measuring and testing equipment, if used during sampling, will be calibrated in accordance with the manufacturer's requirements. Measuring equipment will be calibrated at prescribed intervals and/or before and after use. Calibration frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience.

Each calibration activity will be recorded in the field logbook. It is the responsibility of each individual equipment user to verify the calibration status prior to using the equipment. If equipment malfunction is suspected and calibration failure occurs, the equipment will be removed from service and substitute equipment obtained.

7.0 Decontamination

Depending on the site-specific contaminants, XRF analyzer equipment must be thoroughly decontaminated after use on a daily basis and before retuning the equipment to the storage case. At a minimum, all surfaces of the XRF analyzer should be wiped down and cleaned with disposal, premoistened wipes. Prepackaged and moistened “baby-wipes” can be used for the cleaning of equipment.

8.0 Health and Safety

Depending on the site-specific contaminants, various protective programs must be implemented prior to collecting the first XRF data. The site HSP should be reviewed with specific emphasis placed on the protection program planned for direct contact tasks. Standard SOPs should be followed, including proper monitoring of the equipment and safe use.

- Avoid pointing the XRF in any direction other than at a sample.
- Use safeguards provided on the equipment, such as, the trigger lock.
- Exercise basic radiation safety practices , including time, distance and shielding principles.
- Utilize individual personal protective equipment as required by the HSP to minimize exposure to site contaminants.

Paint Chip Collection for Analysis of Lead

Standard Operating Procedure

Section 02070

Revised June 2010



Environmental Design International inc.

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Paint Chip Collection for Analysis of Lead

1.0 Introduction

This standard operating procedure (SOP) outlines the steps for the collection of paint chip samples in order to determine the lead content of paint on building or other surfaces during environmental investigations. The procedures presented are not intended to address site-specific conditions. The intent is to verify that samples are representative and meet the objectives of the overall sampling program.

2.0 Equipment

2.1 Preparation

Prior to mobilization to the field the following equipment checks will be performed:

- Verify that all equipment required is available and functioning properly. Acquire additional supplies, if necessary.
- Review Health and Safety Plan (HSP) and Sampling Plan (SP), if available.
- Charge any batteries necessary to power field equipment.
- Verify that the appropriate type and number of sample containers required have been obtained.
- Identify nearest location and hours for overnight carrier, if necessary, for sample shipment to laboratory.

2.2 Equipment Checklist

The following equipment list is to be used as a guide for assembling the necessary equipment prior to mobilization. Site-specific requirements will determine the exact equipment needs.

- | | |
|---|---|
| • Field logbook | • Several brushes |
| • Field data sheets | • Buckets |
| • Sampling Plan, if available | • Garden sprayer |
| • Sample location map | • Nonphosphate soap |
| • Tape measure | • Water, distilled or tap, as required |
| • Survey stakes and flags | • Sampling devices |
| • Digital Camera | • Sharpie and/or other writing equipment |
| • Plastic sheeting | • Paper towels |
| • Appropriate health and safety protective equipment (latex gloves) | • Spackle to make repairs |
| • Trash bags | • Sample containers (i.e., bags, vials, etc.) |
| • Tool box to include at a minimum: | |

- screwdriver
 - pliers
 - hacksaw
 - hammer
 - adjustable wrench
 - flashlight
- Respiratory protection
- Sealable plastic bags
- Sample labels
- Chain-of-custody forms and seals
- Shipping containers
- Strapping tape
- Packing material
- Overnight carrier forms

3.0 Field Documentation

Field measurements including sampling locations, sample number, and sample descriptions (paint color, room, wall [direction- i.e. room 101, north wall]) will be documented in the field logbook or on designated field log sheets. Entries in the logbook (or on log sheets) will be made with waterproof ink and will include (please refer to Field Activity Logbook Section 01010), as a minimum:

- Date, time, and personnel present
- Documentation of existing weather conditions
- Field measurements (i.e., sample square footage)
- Unusual events
- Sample location and number
- Sample description
- General chronological description of field activities
- Visitors onsite
- Changes to plans or specifications

4.0 Sample Handling

4.1 Sample Identification and Labeling

All samples collected are to be adequately marked for identification from the time of collection and packaging through shipping. Marking will be by means of a label attached to the sample container. Sample identification will include the sample number. Other information will be provided on the chain-of-custody forms, as appropriate:

- Project name and number
- Sample type
- Sample location (nomenclature)
- Sampling date and time
- Requested analysis
- Sampler's initials, unless using project specific format (i.e., forms II Lite)

Sample labels are to be completed for each sample using waterproof ink affixed to the sample container.

4.2 Sample Containers and Preservation

Samples should be collected in appropriate sized sample container. No preservation methods are required for paint chip samples.

4.3 Sample Packaging and Shipment

The following procedures will be used for sample management:

- Close sample container securely.
- Check to make sure that the sample labeling has been completed with all appropriate information.
- Put chain-of-custody forms with the samples. If more than one group of samples is being shipped in the same container make sure to place the chain-of-custody form in each plastic bag with the associated samples.
- If shipping, affix airbill with shipper's and consignee's addresses on the top of the shipping container.

4.4 Sample Custody Procedures

Chain-of-custody forms will be prepared for each sample collected for laboratory analysis. The chain-of-custody form will be used to document sample possession from the time of collection to disposal. Each time custody of a sample changes, the new custodian will sign the form and document the time and date. A sample will be considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with the samples, after being in physical possession and/or
- In a secured area, restricted to authorized personnel

The following chain-of-custody procedures will be followed for all samples collected for laboratory analysis:

- A chain-of-custody record will be initiated in the field for each sample. A copy of this record will accompany the samples.
- The chain of custody will be a paper form provided by the laboratory or electronic Forms II Lite program as required by USEPA.
- Each time the responsibility for custody of the sample changes, the new custodian will sign the record and denote the date on the "Received By" box. When the sample changes custody again, the person signs the "Relinquished By" box, and notes the date and time.
- If the samples are transported directly to the laboratory, the chain-of-custody record will remain with the samples.
- If commercial carrier ships the samples to the laboratory, the chain-of-custody record will be sealed in a shipping container with the samples. The shipping container will be sealed prior to relinquishing it to the carrier.
- For samples shipped by commercial carrier, the airbill will serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory.

5.0 Sampling Procedures

Paint chip collection is typically performed to identify lead content in paints or coatings, or to confirm the results of a lead-based paint survey completed using X-Ray Fluorescence (XRF) technologies. Paint chips are sent to an accredited laboratory for lead analysis, and analytical results are compared to regulatory standards. Laboratory results of 0.5 percent or greater are considered positive for lead.

5.1 General Sampling Procedures

Paint sampling will be conducted following a limited and modified sampling scheme based on the U.S. Department of Housing and Urban Development (HUD) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (1995 and 1997 Revision).

Perform a visual inspection to identify representative areas of paint. After painted surfaces are identified and grouped into representative areas, collect paint chip samples from these areas.

1. Before collecting each new sample, put on a new pair of non-powdered disposable gloves, in order to avoid cross-contamination.
2. Choose a sampling location. If the sampling site is an active building, attempt to collect sample from an unobtrusive area.
3. Using a sharp stainless steel paint scraper or equivalent sampling tool, cut a painted surface area approximately 4 square inches in size. If possible, collect an equivalent amount of loose paint chips from a surface area where paint is already peeling, using the scraper if necessary.
4. Remove all painted layers from the substrate. Scrape the paint chips onto a clean creased piece of paper or other temporary collection device. If necessary, use a clean sheet of plastic under the area to be sampled to capture paint chips that may fall below during sampling.
5. Place collected paint chips including any residue left on scraper in a sample container (sample vial, sample bag, etc.).
6. Label container with the appropriate sample label, including sample identification number and project/sample location information.
7. Clean sample scraper or sampling tool with a disposable wipe, discard gloves, and put on a new pair of gloves (see Step 1 above).
8. For additional samples, repeat Steps 2 through 7.
9. When finished sampling, clean sampling area by wet wiping, and reseal scraped surface with spackling or new paint if necessary.
10. Discard gloves and wash hands thoroughly with soap and water.
11. Complete field sampling logs with the following information for each sample: specific sampling location, the date and time of sample collection, description of paint (color, condition, etc.), type of building component sampled, etc. Also, document each sampling location on a floor plan.
12. Complete chain-of-custody documentation, including laboratory name and address, sample collection date, and sampler name and signature. Check that the list of samples on the chain-of-custody form matches the information on the actual sample labels.
13. Submit samples to a laboratory accredited by the Environmental Protection Agency (EPA) National Lead Laboratory Accreditation Program. Include the original chain-of-custody form and keep a copy of the form for project files.

A map shall be drawn of the site. All rooms, including hallways, shall be numbered, the numeric order being drawn as the inspector traverses the house clockwise. Walls shall be labeled A, B, C, and D. Wall A shall be the wall the front door of the building is on, as seen from the interior. The rest of the walls are designated by turning clockwise. This is done so all lead-based paint containing surfaces can be accurately pinpointed within the building.

Since no two sites will be exactly the same, the extent of duties and responsibilities of the Inspector will be site specific.

5.2 Certifications

All individuals performing lead inspection or lead risk assessment procedures must be properly trained, certified and licensed as required by federal, state and local regulations. Certifications and a written signature of professionals performing lead inspection or risk assessment services must be provided in the report of lead inspection or risk assessment results.

6.0 Quality Assurance/Quality Control (QA/QC)

There are five primary areas of concern for QA/QC in the collection of representative samples:

1. Obtaining a sample representative of the area
2. Ensuring that the sampling devices are constructed of materials and utilized in a manner that will not interact with or alter the analyses
3. Ensuring that the results generated by these procedures are reproducible; therefore, the sample scheme may incorporate duplicate samples
4. Preventing cross-contamination. Sampling should proceed from the least affected area, if known.
5. Ensuring that samples are properly packaged, and delivered or shipped

7.0 Decontamination

All equipment involved in field sampling activities will be decontaminated before and after sampling and prior to leaving the site. Decontamination of sampling equipment will be conducted as follows:

- Wipe with disposable disinfecting wipe
- Air dry or wipe with a clean paper towel

Decontamination procedures may be altered to address site-specific conditions.

8.0 Health and Safety

Depending on the site-specific contaminants, various protective programs must be implemented prior to collecting the first paint chip sample. The site HSP should be reviewed with specific emphasis placed on the protection program planned for direct contact tasks. Standard SOPs should be followed, including minimization of contact with potential constituents in both the vapor phase and solid matrix through the use of respirators and protective clothing.

Depending on the type of constituent expected or determined in previous sampling efforts, the following safe work practices will be employed:

- Avoid skin contact with and incidental ingestion of peeling paint and dusts
- Utilize protective gloves
- Utilize personal protective equipment as required by the site specific HSP

Appendix D
03030 Residual Sampling SOPs

Residual Sampling

Standard Operating Procedure

Section 03030

Revised December 2009



Environmental Design International inc.

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Residual Sampling

Section 03030

1.0 Introduction

The objective of this document is to provide procedures for collection of representative residual samples. The procedures presented are not intended to address site-specific conditions. The intent is to verify that samples are representative of the particular residuals being sampled and meet the objectives of the overall sampling program.

2.0 Equipment

2.1 Preparation

Prior to mobilization to the field the following equipment checks will be performed:

- Verify that all equipment required is available and functioning properly. Acquire additional supplies, if necessary.
- Review Health and Safety Plan (HSP) and Sampling Plan, if available.
- Verify that factory calibrations on field screening equipment are current.
- Charge any batteries necessary to power field equipment.
- Verify that all sampling locations have been cleared for all aboveground and underground utilities.
- Verify that the appropriate type and number of sample bottles required have been obtained and no breakage has occurred. (Plan for additional sample bottles).
- Identify nearest location and hours for overnight carrier, if necessary, for sample shipment to laboratory.

2.2 Equipment Checklist

The following equipment list is to be used as a guide for assembling the necessary equipment prior to mobilization. Site-specific requirements will determine the exact equipment needs.

- | | |
|-------------------------------|---|
| • Field logbook | • GPS handheld locator |
| • Field data sheets | • Aluminum foil |
| • Sampling Plan, if available | • Photoionization detector, with appropriate lamp |
| • Sample location map | • Several brushes |
| • Tape measure | • Buckets |
| • Survey stakes and flags | |

- Digital camera
- Plastic sheeting
- Appropriate health and safety protective equipment (latex gloves)
- Trash bags
- Tool box to include at a minimum:
 - screwdriver
 - pliers
 - hacksaw
 - hammer
 - adjustable wrench
 - flashlight
- Sample containers
- Sealable plastic bags
- Sample labels
- Chain-of-custody forms and seals
- Shipping containers
- Strapping tape
- Packing material
- Ice
- Overnight carrier forms
- Garden sprayer
- Nonphosphate soap (Alconox)
- Water, distilled or tap, as required
- Stainless steel bowls or buckets
 - if collecting composite samples
- Spade or shovel
- Stainless steel trowel or scoop
- Sampling device
 - hand sampler
 - subcontractor arranged

3.0 Field Documentation

Field measurements including sampling locations, residual descriptions (color, consistency, thickness), and sampling procedures (wipe or container) will be documented in the field logbook. Entries in the logbook (or on log sheets) will be made with waterproof ink and will include (please refer to Field Activity Logbook Section 01010), as a minimum:

- Date, time, and personnel present
- Documentation of existing weather conditions
- Field equipment calibration data
- Field measurements (i.e., sample depth)
- Unusual events
- Sample location and number
- Sample description
- General chronological description of field activities
- Visitors onsite
- Changes to plans or specifications

4.0 Sample Handling

4.1 Sample Identification and Labeling

All samples collected are to be adequately marked for identification from the time of collection and packaging through shipping. Marking will be by means of a label attached to the sample container. Sample identification will include, as appropriate:

- Project name and number
- Sample type
- Sample location(nomenclature)
- Sampling date and time
- Requested analysis
- Sampler's initials, unless using Forms II Lite.

Sample labels are to be completed for each sample using waterproof ink affixed to the sample container, not the lid.

4.2 Sample Containers and Preservation

The type of analysis for which a sample is being collected and the sample matrix determines the type of bottle, preservative, and holding time. Samples should be collected in appropriate containers that have been cleaned to U.S. Environmental Protection Agency (USEPA) standards.

4.3 Sample Packaging and Shipment

The following procedures will be used for sample management:

- Tighten cap securely.
- Check to make sure that the sample labels have been completed with all appropriate information, make sure the sample label is on the jar not the lid.
- Place each container in a sealable plastic bag.
- Place samples in a cooler. If shipment is required, place enough packing material in the cooler to minimize the possibility of container breakage. The temperature will be maintained at 4°C with ice, sealed in plastic bags (if needed for preservation).
- Put chain-of-custody forms in a plastic bag and tape to the inside of the cooler lid.
- Close cooler and if shipping, seal with strapping tape. If the cooler has a drain port, seal it with tape. Place custody seals across the front corners, initial and date custody seals.
- If shipping, affix airbill with shipper's and consignee's addresses on the top of the cooler.

4.4 Sample Custody Procedures

Chain-of-custody forms will be prepared for each sample collected for laboratory analysis. The chain-of-custody form will be used to document sample possession from the time of collection to disposal. Each time custody of a sample changes, the new custodian will sign the form and document the time and date. A sample will be considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with the samples, after being in physical possession and/or
- In a secured area, restricted to authorized personnel

The following chain-of-custody procedures will be followed for all samples collected for laboratory analysis:

- A chain-of-custody record will be initiated in the field for each sample. A copy of this record will accompany the cooler of sample or sample group.
- The chain of custody will be a paper form provided by the laboratory or electronic Forms II Lite program as required by USEPA.
- Each time the responsibility for custody of the sample changes, the new custodian will sign the record and denote the date on the "Received By" box. When the sample changes custody again, the person signs the "Relinquished By" box, and notes the date and time.
- If the samples are transported directly to the laboratory, the chain-of-custody record will remain with the samples.
- If commercial carrier ships the samples to the laboratory, the chain-of-custody record will be sealed in a plastic bag and taped to the inside of the cooler lid. The cooler will be sealed prior to relinquishing it to the carrier.
- For samples shipped by commercial carrier, the airbill will serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory. Samples shipped should also have custody seals placed on the outside of the cooler. The custody seals, if numbered, should be noted on the chain of custody and the date and samplers initials in the custody seals.

5.0 Sampling Procedures

5.1 General Sampling Procedures

Residual samples may be collected using a variety of methods and equipment depending on the sampling conditions. When selecting the appropriate sampling equipment care should be taken to verify that the integrity of the sample is maintained and that the objectives of the sampling program are met. Sampling equipment must also be decontaminated prior to use at each location, or properly disposed.

Residuals samples can be collected through a variety of methods for surface or subsurface samples. Residuals that are on the surface can be placed into laboratory supplied containers (container size, type and preservative, depends on the laboratory analysis to be performed) using a scraping tool (decontaminated) or by hand using gloves. If the residual is a thin layer, a wipe sample may be more appropriate. Wipe samples are collected using a laboratory supplied wipe (with or without preservative) and sample container. A 10-centimeter by 10-centimeter square area is wiped for dust or particulate matter collection and the wipe is placed in the sample container for shipment to the laboratory.

Other general sampling procedures include:

- Perform a general site survey prior to site entry in accordance with the HSP.
- Identify and mark all sampling locations. If required, the proposed locations may be adjusted based onsite access, property boundaries, and surface obstructions.
- Collect the appropriate quality assurance/quality control (QA/QC) samples as outlined in the Sampling Plan.
- Confirm that the correct sample volume has been collected for the required analysis.
- Collect background samples if specified in the sampling plan.
- Record the time and date of sample collection, as well as a description of the sample in the field logbook or on sample log sheets.

5.2 Surface Residual Sampling

Collection of near-surface residual samples can be accomplished with spades, shovels, blades, wipes, and scoops. A stainless steel trowel can be used to collect the sample. Care should be exercised to avoid the use of devices plated with chrome or other materials.

The procedure for collection of surface residual samples is as follows: using the stainless steel trowel, blade or wipe, transfer the sample directly to the appropriate sample jars. Use a 10-centimeter by 10-centimeter template to define the sample area for particulate collection or wipe sample collection. .

6.0 Quality Assurance/Quality Control (QA/QC)

There are six primary areas of concern for QA/QC in the collection of representative samples:

1. Obtaining a sample representative of the residual.
2. Ensuring that the sampling devices are constructed of materials and utilized in a manner that will not interact with or alter the analyses.
3. Ensuring that the results generated by these procedures are reproducible; therefore, the sample scheme may incorporate duplicate samples.

4. Preventing cross-contamination. Sampling should proceed from the least affected area, if known. Rinsate blanks may be incorporated where dedicated sampling equipment is not utilized, and decontamination of the equipment is therefore required. Trip blanks should be incorporated to identify any cross-contamination occurring among samples during shipment.
5. Ensuring that the samples are properly packaged, and delivered or shipped.
6. Calibrating equipment for obtaining field measurements.

6.1 QA/QC Samples

QA/QC sample requirements will be evaluated on a site-specific basis and may include field blanks and/or duplicate samples.

Field blanks consist of two different types of blank samples: trip blanks and equipment blanks. The blanks will be analyzed in the laboratory as discreet samples, and their purpose is to assess sampling, decontamination, and transport procedures as possible sources of sample contamination.

Trip blanks are used to assess sample contamination during sample shipment. If required, one trip blank will be sent with each cooler containing water samples to be analyzed for volatile organic compounds (VOCs). (Trip blanks during soil sampling are only necessary if equipment or rinsate blanks are collected.) Trip blanks will be prepared in the laboratory prior to the sampling event in the actual sample containers and kept with VOC samples throughout the sampling event. Each trip blank will be transported to the site, handled like a sample, and returned to the laboratory for VOC analysis without being opened in the field. The trip blank will consist of two 40-milliliter vials filled completely with deionized water.

Equipment or rinsate blanks are designed to demonstrate that sampling equipment has been properly prepared and decontaminated before each sampling event. If required, the frequency of equipment blank collection will be determined during project planning. Equipment blanks are not necessary when dedicated sampling equipment is utilized. Equipment blanks will be prepared by running deionized water through the decontaminated sampling equipment and into the appropriate sample containers for analysis.

Field duplicates are designed to assess sampling and analytical reproducibility. Field duplicate samples will consist of a set of two samples collected independently at a sampling location during a single sampling event. In some instances, the field duplicate can be a blind duplicate, i.e., indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are field duplicates. The field duplicate will be collected in the same manner as the investigative samples and will be analyzed for the same parameters. Sample bottles for the investigative and duplicate samples will be filled as close together in time as possible.

6.2 Calibration Procedures

Field measuring and testing equipment, if used during sampling, will be calibrated in accordance with the manufacturer's requirements. Measuring equipment will be calibrated at prescribed intervals and/or before and after use. Calibration frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, and values given in national standards, intended use, and experience.

Each calibration activity will be recorded in the field logbook. It is the responsibility of each individual equipment user to verify the calibration status prior to using the equipment. If equipment malfunction is suspected and calibration failure occurs, the equipment will be removed from service and substitute equipment obtained.

7.0 Decontamination

All equipment involved in field sampling activities will be decontaminated before and after sampling and prior to leaving the site. Decontamination of sampling equipment will be conducted as follows:

- Potable water rinse
- Trisodium phosphate wash or Alconox, or applicable decontamination solution as appropriate
- Distilled water rinse
- Air dry

Equipment that cannot feasibly be decontaminated by hand such as augers, may require high-pressure steam cleaning prior to use. A temporary plastic liner will be constructed to collect all decontamination water generated during steam cleaning, if required.

Personnel decontamination will follow procedures contained in site-specific HSPs.

Decontamination procedures may be altered to address site-specific conditions.

8.0 Health and Safety

Depending on the site-specific contaminants, various protective programs must be implemented prior to collecting the first soil sample. The site HSP should be reviewed with specific emphasis placed on the protection program planned for direct contact tasks. Standard SOPs should be followed, including minimization of contact with potential constituents in both the vapor phase and solid matrix through the use of respirators and protective clothing.

Depending on the type of constituent expected or determined in previous sampling efforts, the following safe work practices will be employed:

- Particulate or inorganic constituents

- Avoid skin contact with and incidental ingestion of soils and dusts
- Utilize protective gloves
- VOCs
 - Avoid breathing constituents volatilizing from the soil or boring
 - Screen the breathing zone with a photoionization detector prior to sampling
 - If monitoring results indicate organic constituents, adjust protective equipment as necessary

Attachment C
Site Management Plan

SITE MANAGEMENT PLAN - DRAFT

**EAGLE ZINC SITE OU1
Hillsboro, Illinois**

Remedial Design

WA No. 067-RDRD-B5Y7/Contract No. EP-S5-06-01

June 2010

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Introduction

This Site Management Plan was developed to address the remedial design activities at the Eagle Zinc Site. The Site Management Plan describes the management responsibilities during field activities regarding access, security, contingency procedures, connection of utilities, storage and disposal of investigation-derived waste, and other procedures to be followed in the field.

These plans were prepared in conjunction with the following site-specific plans prepared by CH2M HILL:

- The Quality Assurance Project Plan (QAPP) describes the project objectives and organization, functional activities, sampling objectives, sampling locations and analysis, sampling procedures, handling, equipment, and a breakdown of samples to be analyzed. The QAPP will also include quality assurance/quality control protocols that will be used to achieve the data quality objectives (DQOs).
- The Health and Safety Plan discusses the task-specific health and safety requirements and contingency procedures, including emergency procedures and spill reporting.

Site Investigation Activities

Tasks to be conducted during the site investigation are specified in the QAPP and include the following:

- Site reconnaissance
- Mobilization
- Sampling asbestos containing material and lead-based paint
- Hazardous materials survey
- Conduct a well inventory
- Demobilization

It is estimated that the fieldwork will be completed in 1 week working days beginning in July 2010. It will be the responsibility of the field team leader to conduct the tasks according to the specified procedures. The QAPP describes the project organization structure and management responsibilities.

Site Access

The Eagle Zinc Site is located in Hillsboro, Illinois. The site can be reached by the following directions:

- Take I-55 north from St. Louis to Exit 52 for SR-16, Litchfield
- Turn right on SR-16
- Keep straight onto SR-16 / SR-127 / CR-1200 N 2.6 miles
- Turn left onto SR-16 / School St , MOTO MART on the corner
- Bear left on Industrial Park Drive

- The Eagle Zinc site is on the left and there is a locked gate at the entrance on the West side of the Road
- This gate is the entrance to the site

Right of entry was gained by the USEPA for all investigation areas in OU1.

Site Security

The gate surrounding part of the site should remain locked at all times and should be secured each night. A minimum of two people will be onsite during field activities for safety reasons. The area has an established 911 emergency call number that may be used for emergency assistance.

Field Support Facilities

CH2M HILL and EDI will be working out of field vehicles for the duration of the field event. All sampling containers, samples, and equipment will be transported to and from the site in the field vehicles.

Identification and Management of Investigation-Derived Waste

Investigation-derived waste including disposable personal protection equipment, decontamination resources (i.e. water, wet wipes, paper towels), general packaging (i.e. water bottles, cardboard from sample containers, utility knife packaging) will be collected, stored, and prepared for proper disposal. Material remaining after sample collection will be left in a manner as to not promote or allow a friable release, based on existing conditions at time of sample extraction. Decontamination rinse will be sprayed on tools and dried with a paper towel. Rinse water is not expected in a quantity that would be measurable for collection.

Attachment D
Health and Safety Plan

OU1 of the Eagle Zinc Site

Prepared for
United States Environmental Protection Agency

June 2010



1034 South Brentwood Blvd
Suite 2300
Richmond Heights, MO 63117

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Attachment 11	Vehicle Accident Guidance

Approval

This site-specific Health and Safety Plan (HSP) has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

By approving this HSP, the Responsible Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

Original Plan

RHSM Approval: Mark Orman

Date: June 14, 2010

Field Operations Manager Approval:

Date:

Project Manager Approval: Lisa Cundiff

Date: June 16, 2010

Revisions

Revisions Made By:

Date:

Description of Revisions to Plan:

Revisions Approved By:

Date:

1.0 Introduction

CH2MHILL

HSSE
TargetZero
World-Class Performance

Health, Safety, Security, and Environment Policy

Protection of people and the environment is a CH2M HILL core value. It is our vision to create a culture within CH2M HILL that empowers employees to drive this value into all global operations and achieve excellence in health, safety, security, and environment (HSSE) performance. CH2M HILL deploys an integrated, enterprise-wide behavior-based HSSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:



- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for the actions of their fellow employees to create a safe, healthy, secure, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSSE processes to customer needs and requiring all CH2M HILL employees and subcontractors to deliver projects with agility, personal service, and responsiveness and in compliance with HSSE requirements and company standards to achieve health, safety, security, and pollution prevention excellence. Our performance will aspire to influence others and continually redefine world-class HSSE excellence.
- We systematically evaluate our design engineering and physical work environment to verify safe and secure work conditions and practices are established, consistently followed, and timely corrected.
- We continually assess and improve our HSSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely reviewing our progress.
- We care about the safety and security of every CH2M HILL employee and expect all employees to embrace our culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and “walk the talk” on and off the job.

The undersigned pledge our leadership, commitment, and accountability for making this policy a reality at CH2M HILL.

Dated the 2nd day of September 2008.




Ralph R. Peterson, Chairman of the Board
& Chief Executive Officer



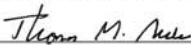
Robert C. Allen, Senior Vice President & Chief Human
Resources Officer



Garry M. Higdon, President, Energy & Chemicals



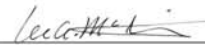
Mark A. Lasswell, President & Chief Executive, Civil Infrastructure



Thomas G. Searle, President & Chief Executive, International



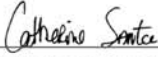
Bob C. Card, Chairman, CH2M HILL International



Lee A. McIntire, President & Chief Operating Officer;
President & Chief Executive, Energy



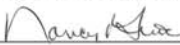
Don S. Evans, Vice Chair, Board of Directors; Chief Marketing Officer



Catherine Santee, Senior Vice President & Chief Financial Officer



Michael E. McKelvy, President & Chief Executive, Industrial



Nancy R. Tuor, President & Chief Executive, Federal



Jacqueline Rast, President & Chief Executive, CPE



Keith Christopher, Senior Vice President, Health, Safety,
Security, and Environment

1.1 CH2M HILL Policy and Commitment

1.1.1 Safe Work Policy

It is the policy of CH2M HILL to perform work in the safest manner possible. Safety must never be compromised. To fulfill the requirements of this policy, an organized and effective safety program must be carried out at each location where work is performed.

CH2M HILL believes that all injuries are preventable, and we are dedicated to the goal of a safe work environment. To achieve this goal, every employee on the project must assume responsibility for safety.

Every employee is empowered to:

- Conduct their work in a safe manner
- Stop work immediately to correct any unsafe condition that is encountered
- Take corrective actions so that work may proceed in a safe manner

Safety, occupational health, and environmental protection will not be sacrificed for production. These elements are integrated into quality control, cost reduction, and job performance, and are crucial to our success.

1.1.2 Health and Safety Commitment

CH2M HILL has embraced a philosophy for health and safety excellence. The primary driving force behind this commitment to health and safety is simple: employees are CH2M HILL's most significant asset and CH2M HILL management values their safety, health, and welfare. Also, top management believes that all injuries are preventable. CH2M HILL's safety culture empowers employees at all levels to accept ownership for safety and take whatever actions are necessary to eliminate injury. Our company is committed to world-class performance in health and safety and also understands that world-class performance in health and safety is a critical element in overall business success.

CH2M HILL is committed to the prevention of personal injuries, occupational illnesses, and damage to equipment and property in all of its operations; to the protection of the general public whenever it comes in contact with the Company's work; and to the prevention of pollution and environmental degradation.

Company management, field supervisors, and employees plan safety into each work task in order to prevent occupational injuries and illnesses. The ultimate success of CH2M HILL's safety program depends on the full cooperation and participation of each employee.

CH2M HILL management extends its full commitment to health and safety excellence.

1.1.3 Project-Specific Health, Safety, and the Environment Goals

All management and employees are to strive to meet the project-specific Health, Safety, and the Environment (HSE) goals outlined below. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

The Project has established eleven specific goals and objectives:

- Create an injury-free environment
- Have zero injuries or incidents

- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example
- Ensure effective implementation of the HSP through education, delegation, and team work
- Ensure 100 percent participation in HSE compliance
- Continuously improve our safety performance
- Maintain free and open lines of communication
- Make a personal commitment to safety as a value
- Focus safety improvements on high-risk groups
- Continue strong employee involvement initiatives
- Achieve health and safety excellence

2.0 Applicability

This HSP applies to:

- All CH2M HILL staff, including subcontractors and tiered subcontractors of CH2M HILL working on the site
- All visitors to the construction site in the custody of CH2M HILL (including visitors from the Client, the Government, the public, and other staff of any CH2M HILL company)

This HSP does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of CH2M HILL.

This HSP defines the procedures and requirements for the health and safety of CH2M HILL staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This HSP will be kept onsite during field activities and will be reviewed as necessary. The HSP will be amended or revised as project activities or conditions change or when supplemental information becomes available. The HSP adopts, by reference, the enterprise-wide core standards and standard operating procedures (SOPs), as appropriate. In addition, the HSP may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this HSP and any governing regulation, the more stringent and protective requirement shall apply.

All CH2M HILL staff and subcontractors must sign the employee sign-off form included in this document as Attachment 1 to acknowledge review of this document. Copies of the signature page will be maintained onsite by the Safety Coordinator (SC).

3.0 General Project Information

3.1 Project Information and Background

Project Number: 403933

Client: USEPA

Project/Site Name: Eagle Zinc Site Operable Unit 1 (OU1)

Site Address: Industrial Park Drive, Hillsboro, IL

CH2M HILL Lisa Cundiff

CH2M HILL Office: STL

DATE HSP Prepared: 5/27/10

Date(s) of Site Work: 7/1/10 through 8/30/10

3.2 Site Background and Setting

The site is located in a mixed industrial/commercial/residential area in Hillsboro, Montgomery County, Illinois. The site is approximately 132 acres with about 30 acres of buildings and associated structures. There are about 23 buildings onsite that were previously used for facility operations; the types of buildings include offices laboratories, manufacturing/processing, equipment/raw material/finished product storage, bag houses and maintenance facilities. Also located onsite are railroad spurs, residual material, two stormwater retention ponds, a small pond and several roads. Active industrial operations ceased in 2003. The area has been zoned commercial/industrial and there are no plans to rezone the area for other uses.

Previous investigations have taken place since the early 1980's. The initial remedial investigation (RI) started in 2001 and a draft RI Report was produced in 2005. The previous investigations show multiple residue piles throughout the site that exceed screening levels. The contaminants of concern (COC) onsite include lead and cadmium. Other contaminants onsite include copper, zinc, and manganese. In 2008, the buildings and associated structures onsite were sampled via XRF and revealed significantly high levels of lead concentrations in, on, and around the building structures. This sampling event led the USEPA decision to complete an interim action to address the immediate threat posed by the buildings. A removal action was conducted in January 2009 to quickly mitigate site access and exposure; the action consisted of fence installation around the most accessible areas of the site.

The USEPA has divided the site into two operable units (OUs) to effectively deal with the short-term risks, lead in buildings, and the long-term risks, contaminated soil and groundwater onsite. OU-1 building demolition is the focus of this Remedial Design.

3.3 Description of Tasks

All CH2M HILL and Subcontractor employees engaging in hazardous waste operations (HAZWOPER) or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65 (or if required by Subcontract). Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities. See the following tasks that fall under HAZWOPER requirements.

3.3.1 HAZWOPER-Regulated Tasks

Lead sampling
Asbestos sampling

Site Survey for hazardous materials

3.3.2 Non-HAZWOPER Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. The following tasks do not involve exposure to safety or health hazards associated with the hazardous waste operations. HAZWOPER training or medical requirements do not apply for the tasks listed below.

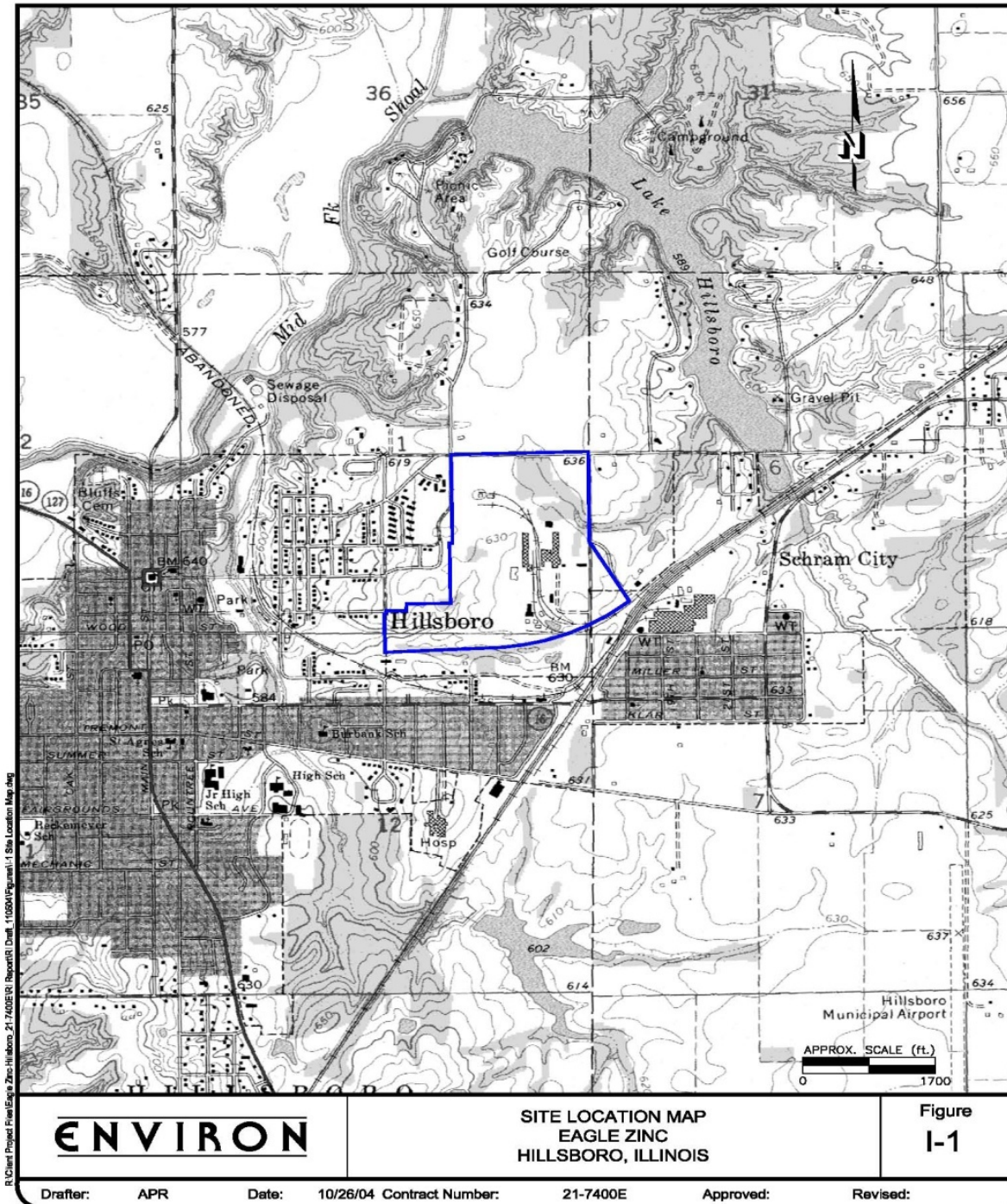
TASKS

- Site walk

CONTROLS

- Brief on hazards, limits of access, and emergency procedures
- Post areas of contamination as appropriate
- Perform air sampling/monitoring as specified in this HSP

Site Map



4.0 Project Organization and Responsibilities

4.1 Client

Contact Name: Nefertiti Simmons

Phone: 312-886-6148

Facility Contact Name: Use USEPA Contact Name (facility is vacant)

Phone: 312-886-6148

4.2 CH2M HILL

4.2.1 Project Manager

Project Manager Name: Lisa Cundiff

Job Title: Project manager

CH2M HILL Office: STL

Telephone Number: 314-335-3010

Cellular Number: 618-610-6120

The project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE management process. The PM has overall management responsibility for the tasks listed below. The PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this document:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors)
- Select safe and competent subcontractors by:
 - Choosing potential subcontractors based on technical ability and HSE performance
 - Implementing the subcontractor prequalification process
 - Ensuring that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award
 - Ensuring HSE submittals, subcontract agreements, and appropriate site-specific safety procedures are in place and accepted prior field mobilization
- Ensure copies of training and medical monitoring records, and site-specific safety procedures are being maintained in the project file accessible to site personnel
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and/or procedures
- Manage the site and interfacing with third parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented
- Support and implement use of stop-work orders when subcontractor safety performance is not adequate

4.2.2 CH2M HILL Responsible Health and Safety Manager (RHSM)

RHSM Name: Mark Orman

Job Title: ESG Federal Sector HSM

CH2M HILL Office: MKE

Telephone Number: 414-847-0597

Cellular Number: 414-712-4138

The RHSM is responsible for the following:

- Review and evaluate subcontractor HSE performance using the prequalification process
- Approve HSP and its revisions as well as activity hazard analyses (AHA)
- Review and evaluate subcontractor site-specific safety procedures for adequacy prior to start of subcontractor's field operations
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices
- Permit upgrades/downgrades in respiratory protection after reviewing analytical data
- Conduct audits as determined by project schedule and coordination with PM
- Participate in incident investigations, lessons learned, loss/near loss reporting

4.2.3 CH2M HILL Safety Coordinator (SC)

SC Name: Wayne Conway

Job Title: Staff Geologist

CH2M HILL Office: STL

Telephone Number: 314-335-3060

Cellular Number: 314-971-7507

The SC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Verify this HSP is current and amended when project activities or conditions change;
- Verify CH2M HILL site personnel and subcontractor personnel read the HSP and sign the employee sign-off form, prior to commencing field activities
- Verify CH2M HILL site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in this HSP
- Verify that project files available to site personnel include copies of executed subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractor's license, training and medical monitoring records, and accepted site-specific safety procedures prior to start of subcontractor's field operations
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the HSP
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the HSP
- Post the Occupational Safety and Health Administration (OSHA) job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established

- Hold and/or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change)
- Verify that project health and safety forms and permits are being used as outlined this HSP
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined this HSP
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and third-party interfaces
- Verify appropriate personal protective equipment (PPE) use, availability, and training
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented
- Conduct accident investigations including root cause analysis
- Calibrate and conduct air monitoring in accordance with the HSP; maintain all air monitoring records in project file
- Maintain HSE records and documentation
- Facilitate OSHA or other government agency inspections including accompanying inspector and providing all necessary documentation and follow-up
- Deliver field HSE training as needed based on project-specific hazards and activities
- Contact the RHSM and PM in the event of an incident
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and RHSM as appropriate
- Document all verbal health and safety-related communications in project field logbook, daily reports, or other records

4.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-215, *Contracts and Subcontracts*)

Subcontractor: EDI

Subcontractor Contact Name: Patricia Feely

Telephone: 312-345-1400 x 136

Subcontractor:

Subcontractor Contact Name:

Telephone:

Subcontractors must comply with the following activities, and are responsible to:

- Comply with all local, state, and federal safety standards
- Comply with project and owner safety requirements
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings
- Provide a qualified safety representative to interface with CH2M HILL

- Maintain safety equipment and PPE for their employees
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations
- Notify the SC of any accident, injury, or incident immediately and submit reports to CH2M HILL within 24 hours
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers)
- Conduct and document weekly safety inspections of project-specific tasks and associated work areas
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the CH2M HILL HSP, subcontractor HSPs, and subcontractor AHAs and sign appropriate sign-off forms
- Determine and implement necessary controls and corrective actions to correct unsafe conditions

The subcontractors listed above may be required to submit their own site-specific HSP and other plans such as lead or asbestos abatement field sampling plan. Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit their plans to CH2M HILL for review and acceptance before the start of field work.

Subcontractors are also required to prepare AHAs before beginning each activity posing hazards to their personnel. The AHA shall identify the principle steps of the activity, potential health and safety hazards for each step, and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

4.4 Employee Responsibilities

All personnel are assigned responsibility for safe and healthy operations. This concept is the foundation for involving all employees in identifying hazards and providing solutions. For any operation, individuals have full authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions or practices. This right represents a significant facet of worker empowerment and program ownership. Through shared values and a belief that all accidents are preventable, our employees accept personal responsibility for working safely.

Each employee is responsible for the following performance objectives:

- Perform work in a safe manner and produce quality results
- Perform work in accordance with company policies, and report injuries, illnesses, and unsafe conditions
- Complete work without injury, illness, or property damage
- Report all incidents immediately to supervisor, and file proper forms with a human resources representative
- Report all hazardous conditions and/or hazardous activities immediately to supervisor for corrective action
- Complete an HSE orientation prior to being authorized to enter the project work areas

4.4.1 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work, and during employee orientation, each employee will be informed of their authority to do so.

4.5 Client Contractors

(Reference CH2M HILL SOP HSE-215, *Contracts, Subcontracts, and HSE Management Practices*)

Contractor: EDI
Contact Name: Patricia Feeley
Telephone: 312-345-1400 x136
Contractor Task(s): Perform work in the Work Plan

This HSP does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues). In addition to these instructions, CH2M HILL team members should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Self-assessment checklists are to be used by the SC and CH2M HILL team members to review the contractor's performance only as it pertains to evaluating CH2M HILL exposure and safety. The RHSM is the only person who is authorized to comment on or approve contractor safety procedures.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL team members on the precautions related to the contractor's work
- When an apparent contractor noncompliance or unsafe condition or practice poses a risk to CH2M HILL team members:
 - Notify the contractor safety representative
 - Request that the contractor determine and implement corrective actions
 - If necessary, stop affected CH2M HILL work until contractor corrects the condition or practice
 - Notify the client, PM, and RHSM as appropriate

If apparent contractor noncompliance or unsafe conditions or practices are observed, inform the contractor safety representative (CH2M HILL's obligation is limited strictly to informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative (CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

All verbal health and safety-related communications will be documented in project field logbook, daily reports, or other records.

5.0 Standards of Conduct

All individuals associated with this project must work injury-free and drug-free and must comply with the following standards of conduct, the HSP, and the safety requirements of CH2M HILL. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

5.1 Standards of Conduct Violations

All individuals associated with this project are expected to behave in a professional manner. Violations of the standards of conduct would include, but not be limited to:

- Failure to perform work
- Inefficient performance, incompetence, or neglect of work
- Willful refusal to perform work as directed (insubordination)
- Negligence in observing safety regulations, poor housekeeping, or failure to report on-the-job injuries or unsafe conditions
- Unexcused or excessive absence or tardiness
- Unwillingness or inability to work in harmony with others
- Discourtesy, irritation, friction, or other conduct that creates disharmony
- Harassment or discrimination against another individual
- Failure to be prepared for work by wearing the appropriate construction clothing or bringing the necessary tools
- Violation of any other commonly accepted reasonable rule of responsible personal conduct

5.2 Disciplinary Actions

The Environmental Services (ES) business group employees, employees working on ES business group projects, and subcontractor employees are subject to disciplinary action for not following HSE rules and requirements. Potential disciplinary action is equally applicable to all employees including management and supervision. Disciplinary action may include denial of access to the worksite, warnings, reprimands, and other actions up to and including termination depending on the specific circumstances.

5.3 Subcontractor Safety Performance

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

5.3.1 Observed Hazard Form

When apparent noncompliance or unsafe conditions or practices are observed, notify the subcontractor's supervisor or safety representative verbally, and document using the observed hazard form, included as an attachment to this HSP, and require corrective action.

If necessary, stop subcontractor's work using the stop work order form until corrective actions is implemented for observed serious hazards or conditions. Update the observed hazard form to document corrective actions have been taken. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

5.3.2 Stop Work Order

CH2M HILL has the authority, as specified in the contract, and the responsibility to stop work in the event any CH2M HILL employee observes unsafe conditions or failure of the subcontractor to adhere to its safe-work practices. This authority and action does not in any way relieve the subcontractor of its responsibilities for the means and methods of the work or, therefore, of any corrective actions. Failure to comply with safe work practices can be the basis for restriction or removal of the subcontractor staff from the job site, termination of the subcontract, restriction from future work, or all three.

When an apparent imminent danger is observed, immediately stop work and alert all affected individuals. Remove all affected CH2M HILL employees and subcontractor staff from the danger, notify the subcontractor's supervisor or safety representative, and do not allow work to resume until adequate corrective measures are implemented. Notify the PM, Contract Administrator and RHSM.

When repeated noncompliance or unsafe conditions are observed, notify the subcontractor's supervisor or safety representative and stop affected work by completing and delivering the stop work order form (attached to this HSP) until adequate corrective measures are implemented. Consult the Contract Administrator to determine what the contract dictates for actions to pursue in event of subcontractor noncompliance including work stoppage, back charges, progress payments, removal of subcontractor manager, monetary penalties, or termination of subcontractor for cause.

5.4 Incentive Program

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

5.5 Reporting Unsafe Conditions/Practices

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Accident prevention requires a proactive policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition which might jeopardize the

safety of our projects. All unsafe conditions or unsafe practices will be corrected immediately. CH2M HILL has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition.
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SC needs to be notified at once by the responsible employee.
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SC.
- The SC will act promptly to correct the unsafe condition or practice.
- Details of the incident or situation will be recorded by the SC in the field logbook or use the observed hazard form if subcontractor was involved.

6.0 Safety Planning and Change Management

6.1 Daily Safety Meetings and Pre-Task Safety Plans

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews.

At the start of each day's activities, the crew supervisor completes the PTSP, provided as an attachment to this HSP, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools, and equipment that will be used to perform these tasks are listed, along with the hazards posed and required HSE procedures, as identified in the HSP and AHA. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day.

6.2 Change Management

This HSP addresses all known activities and associated hazards. As work progresses, if significant changes are identified which could affect health and safety at the site, coordinate with the RHSM to determine whether a HSP update is necessary.

The following are examples of changes that may require a revision to the plan:

- Change in CH2M HILL staff
- New subcontractor to perform work
- New chemicals brought to site for use
- Change in scope or addition of new tasks
- Change in COCs or change in concentrations of COCs
- New hazards or hazards not previously identified that are not addressed in this HSP

7.0 Project Hazard Analysis

A health and safety risk analysis (Table 1) has been performed for each task. In the order listed below, the RHSM considers the various methods for mitigating the hazards. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects:

- Elimination of the hazards (use remote sampling methodology to avoid going into a confined space)
- Substitution (reduce exposure to vapors by using of a geoprobe instead of test pitting)
- Engineering controls (ventilate a confined space to improve air quality)
- Warnings (establish exclusion zones to keep untrained people away from hazardous waste work)
- Administrative controls (implement a work-rest schedule to reduce chance of heat stress) or
- Use of PPE (use of respirators when action levels are exceeded)

The hazard controls and safe work practices are summarized in the following sections of this HSP:

- General hazards and controls
- Project-specific hazards and controls
- Physical hazards and controls
- Biological hazards and controls
- COCs

7.1 Activity Hazard Analysis (AHA)

An AHA defines the activity being performed, the hazards posed and control measures required to perform the work safely. Workers are briefed on the AHA before doing the work and their input is solicited prior, during, and after the performance of work to further identify the hazards posed and control measures required. The AHA shall identify the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard. In addition, a listing of the equipment to be used to perform the activity as well as inspection requirements and training requirements for the safe operation of the equipment listed must be identified. The following hazard controls and applicable CH2M HILL core standards and SOPs should be used as a basis for preparing AHAs.

AHAs must be prepared for CH2M HILL activities and included as an attachment to this HSP.

7.2 Subcontractor Activity Hazard Analysis

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL. Each subcontractor shall submit AHAs for their field activities, as defined in their scope of work, along with their project-specific safety plan and/or procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

Table 1 – General Activity Hazard Analysis

Potential Hazard	Project Activity	Asbestos, Lead and hazardous materials survey	Site Visit					
Aerial Lifts		X						
Asbestos		X	x					
Biological Hazards		X	x					
Chemical Hazard		X						
Concrete Coring		X						
Drum Handling		x						
Fall Protection		x						
Field Vehicles		x						
Fire Prevention		x						
Forklifts		x						
Hand and Power Tools		x						
Knife Use		x						
Lead		x	x					
Manual Lifting		x						
PCBs/Light Ballasts		x						
Pressure Washing Equipment/ Decontamination		x						
Scaffolding								
Stairways and Ladders		x	x					
Temperature Extremes		x	x					
Ultraviolet Light Exposure (sunburn)		x	x					
Visible Lighting		x	x					
Work Alone								

8.0 General Hazards and Controls

8.1 General Practices and Housekeeping

The following are general requirements applicable to all portions of the work:

- Site work should be performed during daylight hours whenever possible.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Structurally unsound buildings will not be entered.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up; oil and grease shall be cleaned from walking and working surfaces.
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others.
- Familiarize yourself with, understand, and follow jobsite emergency procedures.
- Do not fight or horseplay while conducting the firm's business.
- Do not use or possess firearms or other weapons while conducting the firm's business.
- Report unsafe conditions or unsafe acts to your supervisor immediately.
- Report emergencies, occupational illnesses, injuries, vehicle accidents, and near misses immediately.
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment.
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor.
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion.
- Do not run in the workplace.
- When ascending or descending stairways, use the handrail and take one step at a time.
- Do not apply compressed air to any person or clothing.
- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location.

- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery.
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations.
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible.
- Check the work area to determine what problems or hazards may exist.

8.2 Driving Safety

Follow the guidelines below when operating a vehicle:

- Refrain from using a cellular phone while driving. Pull off the road, put the vehicle in park and turn on flashers before talking on a cellular phone.
- Never operate a personal digital assistant (PDA), or other device with e-mail, internet, or text messaging function while driving a vehicle.
- Obey speed limits and be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you.
- Do not drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep.
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving. Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

8.3 Personal Hygiene

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Implement the following:

- Keep hands away from nose, mouth, and eyes during work
- Keep areas of broken skin (chapped, burned, etc.) covered
- Wash hands with soap and water prior to eating, smoking, or applying cosmetics

8.4 Bloodborne Pathogens

(Reference CH2M HILL SOP HSE-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M HILL's 1-hour bloodborne pathogens computer-based training module annually. When performing first-aid/CPR the following shall apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes.
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

CH2M HILL will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure
- Testing the exposed employee's and the source individual's blood (with consent)
- Administering post-exposure prophylaxis

8.5 Workplace Hazard Material Information System (WHMIS)

(Reference CH2M HILL SOPs HSE-107, *Hazard Communication* and HSE-403, *Hazardous Material Handling*)

The hazard communication coordinator is to perform the following:

- Complete an inventory of chemicals brought onsite by CH2M HILL using the chemical inventory form included as an attachment to this HSP.
- Confirm that an inventory of chemicals brought onsite by CH2M HILL subcontractors is available.
- Request or confirm locations of material safety data sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive onsite, obtain an material safety and data sheet (MSDS) for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific training using the chemical-specific training form included as an attachment to this HSP.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases.
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals).
- Keep flammables and corrosives in appropriate storage cabinets.
- Do not store paper or other combustibles near flammables.
- Use secondary containment and lipped shelving that is secured.

- Have a fire suppression system available.

8.6 Substance Abuse

(Reference CH2M HILL SOP HSE-105, *Drug-Free Workplace*)

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

Prohibitions onsite include:

- Use or possession of intoxicating beverages while performing CH2M HILL work
- Abuse of prescription or nonprescription drugs
- Use or possession of illegal drugs or drugs obtained illegally
- Sale, purchase, or transfer of legal, illegal or illegally obtained drugs
- Arrival at work under the influence of legal or illegal drugs or alcohol

Drug and/or alcohol testing is applicable under CH2M HILL Constructors, Inc. and munitions response projects performed in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. When required, this testing is performed in accordance with SOP HSE-105, *Drug-Free Workplace*. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the CH2M HILL Virtual Office (VO).

8.7 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's Procedures for Shipping and Transporting Dangerous Goods)

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation. All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the RHSM or the Warehouse Coordinator for additional information.

9.0 Project-Specific Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the work or the particular hazard. Each person onsite is required to abide by the hazard controls. Consult the appropriate CH2M HILL SOP to ensure all requirements are implemented. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

9.1 Aerial Lifts

(Reference CH2M HILL, SOP HSE-301, *Aerial Lifts*)

Below are the hazard controls and safe work practices to follow when working around or operating aerial lifts. Ensure the requirements in the referenced SOP are followed.

- Operate aerial lifts only if you are authorized and trained to do so.
- Inspect aerial lifts and test lift controls prior to use.
- Wear a full-body harness, with a lanyard attached to the boom or platform (see also SOP HSE-308, *Fall Protection*). When working within a standard guardrail system with scissors lifts, the full-body harness and lanyard are not required.
- Do not attach lanyard to any adjacent structures or equipment while working from an aerial lift.
- Stand firmly on the floor of the platform and do not sit or climb on the railings of the platform, or use planks, ladders, or other devices to increase working height.
- Remain on the platform at all times and do not leave the platform to climb to adjacent structures.
- Position aerial lifts on firm, level surfaces when possible, with the brakes set. Use wheel chocks on inclines. If outriggers are provided, position them on solid surfaces or cribbing.
- Maintain safe clearance distances between overhead power lines and any part of the aerial lift or conducting material, unless the power lines have been de-energized and grounded, or insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kilovolts (kV) or less, and 10 feet (3 meters) plus ½ inch (1.27 centimeters) for every 1 kV over 50 kV.
- Do not exceed the boom and basket load limits.
- Do not use aerial lifts as cranes, unless specifically designed and approved by the lift manufacturer.
- Do not work or stand below aerial lift operations.
- Do not use aerial lifts when winds exceed 30 miles per hour (48 kilometers per hour) or per manufacturers recommendations.
- Complete the self-assessment checklist for aerial lifts whenever aerial lifts are being used.

9.2 Asbestos

(Reference CH2M HILL SOP HSE-502, *Asbestos*)

Asbestos is a cancer-causing mineral that was included in many building materials. When disturbed harmful asbestos fibers can be released and inhaled and ingested by workers. Materials suspected of

containing asbestos shall be treated as asbestos unless documentation and/or testing results indicate otherwise. Where the presence of asbestos is suspected, if at all possible, design all operations to avoid contact.

When there is a risk of disturbing asbestos and making it friable (able to release fibers when the materials are crushed, abraded, or cut) the activity becomes regulated. The asbestos standard for construction regulates asbestos exposure for the following activities:

- Demolishing or salvaging structures where asbestos is present in concentrations greater than 1 percent
- Removing or encapsulating asbestos-containing materials (1% or greater asbestos content)
- Constructing, altering, repairing, maintaining, or renovating asbestos-containing structures or substrates
- Installing asbestos containing products
- Cleaning up asbestos spills/emergencies
- Transporting, disposing, storing, containing, and housekeeping involving asbestos or asbestos containing products on a construction site

CH2M HILL is required to control employee exposure to asbestos when exposures are at or above 0.1 fibers per cubic centimeter (f/cc) by implementing a program that meets the requirements of the OSHA Asbestos standard, 29 Code of Federal Regulations (CFR) 1926.1101. The elements of the CH2M HILL asbestos program include the following:

- Exposure monitoring
- Methods of control, including PPE and respirators
- Medical Surveillance
- Training on hazards of asbestos and control measures
- Record keeping requirements

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Avoid skin and eye contact asbestos.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Review the fact sheet included as an attachment to this HSP.
- Do not disturb waste or other materials labeled "Danger - Asbestos Fibers."

Subcontractors performing asbestos abatement activities are required to obtain state or special licenses and have a written Field Sampling Plan that has been reviewed and accepted by CH2M HILL before work begins. Subcontractors are required to provide proof that all asbestos workers are medically qualified, trained and competent before work begins.

9.3 Compressed Gas Cylinders

(Reference CH2M HILL SOP HSE-403, *Hazardous Materials Handling*)

Below are the hazard controls and safe work practices to follow when working around or using compressed gas cylinders. Ensure the requirements in the referenced SOP are followed.

- Cylinders and pressure-controlling apparatus shall be inspected for defects and leakage prior to use. Damaged or defective items shall not be used. If a cylinder is found to be defective, the gas distributor shall be notified and subsequent instructions followed. If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.
- Cylinders shall be labeled with the identity of the contents. Cylinders not labeled shall be sent back to the cylinder distributor. The color of the cylinder shall not be used exclusively to identify cylinder contents.
- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinders must be secured in an upright position at all times.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.
- Eye protection (safety glasses or goggles) shall be worn when using cylinders.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders inside buildings shall be stored in dry, well-ventilated locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high, having a fire resistance rating of at least 0.5 hour.
- Signs indicating no smoking shall be provided for storage areas containing flammable gas cylinders.
- Complete the self-assessment checklist for compressed gas cylinders are being used.

9.4 Concrete Core Drilling

Below are the hazard controls and safe work practices to follow when working around or performing concrete core drilling.

- Operators must read and understand the operator manual(s) for the equipment that will be used.
- Follow all manufacturers' operating instructions and comply with all warning labels on the equipment.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.

- Follow all requirements for use of PPE. Minimum PPE includes hearing protection, safety glasses with side shields, and safety toed boots. A face shield over safety glasses or liquid splash goggles may be required for wet coring.
- Inspect areas to be cored to ensure there are no obstructions, for example utilities on the opposite side of a wall to be cored through. Follow utility locate procedures for when coring slab on grade.
- Provide dust control (wet coring or local exhaust for dry coring) to avoid potential silica exposure.
- Make sure that all electrical wiring is grounded.
- The power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard.
- When hydraulic coring equipment is used, all workers must be aware of hydraulic lines running to the coring equipment. Preparations must be made for containment/cleanup in the event of a ruptured hydraulic line.
- All workers must keep their hands and body away from the cutting saw/ cable.
- The power supply must be disconnected when changing bits or conducting other maintenance on the equipment.
- Slippery conditions may exist in wet coring operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.
- Use the drilling self-assessment checklist to evaluate coring operations.

9.5 Drum Handling

Below are the hazard controls and safe work practices to follow when overseeing the movement of drums or when handling drums.

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries.
- Ensure drum bungs/lids are secured and drums are labeled prior to moving.
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; roller conveyor equipped with solid rollers; and drum carts designed specifically for drum handling.
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface.
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials.
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency.
- Supply operators with appropriate respiratory protective equipment when needed.
- Ensure that drums are secure and are not in the operator's view of the roadway.
- Prior to handling, all personnel should be warned about hazards of handling.

- Before moving anything, determine the most appropriate sequence in which the various drums and other containers should be moved (e.g. small containers may have to be removed first to permit heavy equipment to enter and move the drums).
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur.

9.6 Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums.
- Sample only labeled drums or drums from a known waste stream.
- Do not sample bulging or swollen drums. Contact the RHSM.
- If drums contain, or potentially contain, flammable materials, use nonsparking tools to open.
- Use the proper tools to open and seal drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer/sample the content of drums using a method that minimizes contact with material.
- Use the PPE and perform air monitoring as specified in the PPE and site monitoring sections of this HSP.
- Have a spill kit accessible during sampling activities.
- If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

9.7 Electrical Safety

(Reference CH2M HILL SOP HSE-206, *Electrical Safety*)

Below are the hazard controls and safe work practices to follow when using electrical tools, extension cords, and/or other electrical-powered equipment or when exposed to electrical hazards. Ensure the requirements of the referenced SOP are followed.

9.7.1 General Electrical Safety

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- CH2M HILL employees who might from time to time work in an environment influenced by the presence of electrical energy must complete awareness level electrical safety training located on the CH2M HILL VO.

- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout (LO/TO) procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- CH2M HILL has selected ground fault circuit interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock.
 - GFCIs shall be used on all 120-volt, single phase 15 and 20-ampere receptacle outlets that are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
 - GFCIs cannot be utilized
 - Client requires such a program to be implemented
 - Business group decides to implement program in addition to GFCI protection
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated, or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus ½ inch (1.27 cm) (for every 1 kV over 50 kV).
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

9.7.2 Portable Generator Hazards

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of CO very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.

- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with GFCI. Test the GFCIs daily to determine whether they are working.
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools, and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

9.8 Energized Electrical Work

(Reference CH2M HILL SOP HSE-221, *Energized Electrical*)

Energized electrical work is defined as work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a limited approach boundary.

All electrical systems shall be considered energized unless LO/TO procedures are implemented and verified.

Electrical wiring and equipment shall be de-energized prior to conducting work unless it can be demonstrated that de-energizing introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. When energized electrical work is the only means that work can be performed, all requirements of SOP HSE-221 must be implemented including the following:

- Only qualified personnel are permitted to work on unprotected energized electrical systems. These personnel shall complete energized electrical safety training.
- An electrical hazard analysis must be performed to identify energized electrical safe work practices before any person approaches exposed live parts within the limited approach boundary (as determined by the shock hazard analysis), by performing both shock hazard analysis and flash hazard analysis, which comprise the electrical analysis.
- The Energized Electrical Work Permit must be completed prior to working on unprotected energized electrical systems.
- CH2M HILL employees designated as qualified persons working on live parts of energized electrical systems 480 volts and above shall implement the buddy system. Working on live parts of energized electrical systems 480 volts and above means actual contact with live parts or working within the prohibited approach boundary, which is 1 inch (2.54 centimeters) for 480 volt systems.

- The buddy system requires the presence of an additional qualified person who shall stand by and render assistance, or summon help for the first person, in the event the first person is inadvertently shocked while performing the work. The second person shall not be assigned to additional distracting duties or tasks while the energized electrical work is being performed and shall know the location of the isolation device(s) for the equipment being worked on.
- Workers designated as qualified persons shall wear the required electric shock and arc-flash PPE, as specified by the qualified person responsible for the energized electrical operations.
- Safety signs, safety symbols, or accident prevention tags meeting applicable American National Standards Institute (ANSI) Standards, shall be used where necessary to warn employees about electrical hazards.
- Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas containing live parts. Conductive barricades shall not be used where it may cause an electrical hazard. Barricades shall be placed no closer than the limited approach boundary.
- If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect unqualified employees. The primary duty and responsibility of an attendant providing manual signaling and alerting shall be to keep unqualified employees outside a work area where the unqualified employee might be exposed to electrical hazards. An attendant shall remain in the area as long as there is a potential for employees to be exposed to the electrical hazards.
- Employees shall not perform tasks near exposed energized parts where lack of illumination or an obstruction precludes observation of the work. Employees shall not reach blindly into areas that may contain energized parts.
- Work shall be performed in accordance with National Fire Protection Association 70E requirements.
- Follow all control measures and procedures identified on the Energized Electrical Work Permit.

9.9 Fall Protection Activities

(Reference CH2M HILL, SOP HSE-308, *Fall Protection*)

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are exposed to unprotected heights. Ensure the requirements in the referenced SOP are followed.

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet (1.8 meters) or greater and when performing general industry activities at a height of 4 feet (1.2 meters) or greater.
- CH2M HILL staff exposed to fall hazards must complete initial fall protection training by completing either the CH2M HILL 10-Hour Construction Safety Awareness training course or the fall protection computer-based training module. Staff must also receive project-specific fall protection training using the fall protection evaluation form attached to this HSP. Staff shall not use fall protection systems for which they have not been trained.
- The SC or designee must complete the project fall protection evaluation form and provide project-specific fall protection training to all CH2M HILL staff exposed to fall hazards.
- The company responsible for the fall protection system shall provide a fall protection competent person to inspect and oversee the use of fall protection system. CH2M HILL staff shall be aware of

and follow all requirements established by the fall protection competent person for the use and limitation of the fall protection system.

- When CH2M HILL designs or installs fall protection systems, staff shall be qualified as fall protection competent persons or work directly under the supervision of a CH2M HILL fall protection competent person.
- When horizontal lifelines are used, the company responsible for the lifeline system shall provide a fall protection qualified person to oversee the design, installation, and use of the horizontal lifeline.
- Inspect personal fall arrest system components prior to each use. Do not use damaged fall protection system components at any time, or for any reason. Fall protection equipment and components shall be used only to protect against falls, not to hoist materials. Personal fall arrest systems that have been subjected to impact loading shall not be used. The SC shall periodically inspect CH2M HILL fall protection equipment using the fall protection inspection log form.
- Personal fall arrest systems shall be configured so that individuals can neither free-fall more than 6 feet (1.8 meters) or contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds (2268 kg). Do not attach personal fall arrest systems to guardrail systems or hoists.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted. Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Only one person shall be simultaneously attached to a vertical lifeline and shall also be attached to a separate independent lifeline.

9.10 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first-aid kit, bloodborne pathogen kit, and fire extinguisher in the field vehicle at all times.
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Car rental must meet the following requirements:
 - Dual air bags
 - Antilock brakes
 - Be midsize or larger
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
 - Vision fields and blind spots
 - Vehicle size
 - Mirror adjustments
 - Seat adjustments
 - Cruise control features, if offered
 - Pre-program radio stations and global positioning system, if equipped

- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van or pick-up truck.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.
- Ensure backup alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.

9.11 Fire Prevention

(Reference CH2M HILL SOP HSE-403, *Hazardous Material Handling*)

Follow the fire prevention and control procedures listed below.

9.11.1 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). Extinguishers must:
 - Be maintained in a fully charged and operable condition
 - Be visually inspected each month
 - Undergo a maintenance check each year
- The area in front of extinguishers must be kept clear.
- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet (3 meters) from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.

9.12 Hand and Power Tools

(Reference CH2M HILL, SOP HSE-210, *Hand and Power Tools*)

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed.

- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service.
- Hand tools will be used for their intended use and operated in accordance with manufacturer’s instructions and design limitations.
- Maintain all hand and power tools in a safe condition.

- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool.
- Do not carry or lower a power tool by its cord or hose.
- Portable power tools will be plugged into GFCI protected outlets.
- Portable power tools will be Underwriters Laboratory listed and have a three-wire grounded plug or be double insulated.
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters).
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed.
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials.
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications.
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

9.13 Knife Use

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multipurpose tools with fixed blades such as a Leatherman™) are prohibited at worksites except where the following three conditions are met:

- The open-bladed knife is determined to be the best tool for the job
- An approved AHA or written procedure is in place that covers the necessary safety precautions (work practices, PPE, and training)
- Knife users have been trained and follow the AHA

9.14 Lead

(Reference CH2M HILL SOP HSE-508, *Lead*)

CH2M HILL is required to control employee exposure to lead when exposures are at or above 30 µg/m³ by implementing a program that meets the requirements of the OSHA Lead standard, 29 CFR 1910.1025 and 29 CFR 1926.62. The elements of the CH2M HILL lead program include the following:

- Exposure monitoring
- Methods of control, including PPE and respirators
- Medical surveillance
- Training on hazards of lead and control measures (includes project-specific training and the computer-based training on CH2M HILL's VO, *Lead Exposure Training*)
- Record keeping requirements

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Review the fact sheet included as an attachment to this HSP.

9.15 Lockout/Tagout (LO/TO) Activities

(Reference CH2M HILL SOP HSE-310, *Lockout and Tagout*)

LO/TO shall be performed whenever service or maintenance is necessary on equipment that could cause injury to personnel from the unexpected equipment energizing or start-up or unexpected release of stored energy. Energy sources requiring LO/TO may include electrical, pneumatic, kinetic, and potential.

If work on energized electrical systems is necessary contact the RHSM. Specific training and procedures are required before any work on energized electrical systems can be performed and are NOT covered in this section. Energized electrical work is defined as work performed **on or near** energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a limited approach boundary (anywhere from 3.5 feet to 24 feet [1 meter 7.3 meters] depending on voltage). Examples of energized electrical work include using a volt meter to troubleshoot electrical systems and changing out controllers.

When LO/TO is necessary to perform maintenance/repair of a system, all the requirements of SOP HSE-310, Lockout and Tagout, shall be met including the following bulleted items:

- When CH2M HILL controls the work, CH2M HILL must verify that subcontractors affected by the unexpected operation of equipment develop a written LO/TO program, provide training on LO/TO procedures and coordinate its program with other affected subcontractors. This may include compliance with the owner or facility LO/TO program.

- When CH2M HILL personnel are affected by the unexpected operation of equipment, they must complete the electrical safety awareness module on the VO. Authorized personnel shall inform the affected personnel of the LO/TO. Affected personnel shall not tamper with LO/TO devices.
- Standard LO/TO procedures include the following six steps: 1) notify all personnel in the affected area of the LO/TO, 2) shut down the equipment using normal operating controls, 3) isolate all energy sources, 4) apply individual lock and tag to each energy isolating device, 5) relieve or restrain all potentially hazardous stored or residual energy, and 6) verify that isolation and de-energization of the equipment has been accomplished. Once verified that the equipment is at the zero energy state, work may begin.
- All safe guards must be put back in place, all affected personnel notified that lockout has been removed and controls positioned in the safe mode prior to lockout removal. Only the individual who applied the lock and tag may remove them.
- CH2M HILL authorized employees shall complete the LO/TO training module on the VO and either the electrical safety training module on the VO or 10-hour construction training. The authorized employee must also be trained and qualified on the system they are working on (e.g., qualified electrician for working on electrical components of a system).
- When equipment-specific LO/TO procedures are not available or when existing procedures are determined to be insufficient, CH2M HILL authorized employees shall also complete the equipment-specific LO/TO procedure development form, provided as an attachment to this HSP, to create an equipment-specific LO/TO procedure.

9.16 Manual Lifting

(Reference CH2M HILL SOP HSE-112, *Manual Lifting*)

Back injuries are the leading cause of disabling work and most back injuries are the result of improper lifting techniques or overexertion. Use the following to mitigate the hazards associated with lifting:

- When possible, the task should be modified to minimize manual lifting hazards.
- Lifting of loads weighing more than 40 pounds (18 kilograms) shall be evaluated by the SC using the lifting evaluation form contained in SOP HSE-112.
- Using mechanical lifting devices is the preferred means of lifting heavy objects such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys.
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities.
- In general, the following steps must be practiced when planning and performing manual lifts:
 - Assess the situation before you lift
 - Ensure good lifting and body positioning practices
 - Ensure good carrying and setting down practices
- All CH2M HILL workers must have training in proper manual lifting training either through the new employee orientation or through manual lifting module located on the VO.

9.17 Process Safety Management (PSM)

(Reference CH2M HILL SOP HSE-213, *Process Safety Management*)

- All CH2M HILL projects require a systematic evaluation of processes to prevent, or minimize the consequences of, catastrophic releases of toxic, reactive, flammable, or explosive chemicals at or above the specified threshold quantities listed in Appendix A, List of Highly Hazardous Chemicals, Toxics, and Reactives in OSHA Standard 29 CFR 1910.119, Process Safety Management.
- A process hazard analysis is required of all processes covered by process safety management (PSM).
- Operating procedures shall be developed and implemented that provide clear operating instructions consistent with the process safety information.
- Contractors, whether considered to be CH2M HILL or a subcontractor of CH2M HILL, performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process shall be informed by the client of the known potential fire, explosion, and toxic release hazards related to the contractor work and the provisions of the emergency action plan.
- CH2M HILL projects shall develop and implement the written procedure requirements to maintain the mechanical integrity of pressure vessels, storage tanks, piping systems, relief and vent systems, emergency shutdown systems, and controls and pumps process systems.
- A hot work permit shall be completed for any CH2M HILL work involving welding, cutting, brazing, or similar flame- or spark-producing operations conducted near a covered process.
- Written procedures shall be developed, updated, and implemented to manage changes in chemicals, technology, equipment, and facilities.
- An incident report form (IRF) shall be completed within 24 hours of a PSM-related incident. Incidents involving a release of highly hazardous chemicals shall be reported following the serious incident reporting section of SOP HSE-111.
- An investigation shall be initiated as soon as possible, but no later than 48 hours following an incident that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical.
- An emergency action plan shall be developed and implemented for the entire plant, including procedures for handling small releases.
- A facility or process audit shall be performed every 3 years to certify compliance with the PSM standard.
- All information regarding compliance with PSM requirements shall be made available to affected personnel without regard to possible trade secret status.
- CH2M HILL employees shall be trained before operating a newly assigned process or when involved in maintaining equipment. Refresher training shall be provided at least every three years and more often if necessary to assure the employee understands and adheres to the current operating procedures of the process.

9.18 Stairways and Ladders

(Reference CH2M HILL SOP HSE-214, *Stairways and Ladders*)

Below are the hazard controls and safe work practices to follow when using stairways and ladders. Ensure the requirements in the referenced SOP are followed.

- Stairway or ladder is generally required when a break in elevation of 19 inches (48.3 centimeters) or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing and keep belt buckle between side rails.
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb and use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Portable ladders must extend at least 3 feet (91.5 centimeters) above landing surface.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
- Fixed ladders \geq 24 feet (7.3 meters) in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than 6 feet (1.8 meters) from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

9.19 Utilities (underground)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted before any intrusive subsurface activity and must include at least the following elements:

1. Background and records assessment of known utilities or other subsurface obstructions
2. Contact and use the designated local utility locating service
3. Independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions *Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service above.*

4. Visual survey of the area to validate the chosen location

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, then nonaggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator, or other aggressive method is used.

Aggressive methods are never allowed within 2 feet of an identified high risk utility (see paragraph below).

Any deviation from these requirements must be approved by the RHSM and the PM.

Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities. For military installations, contact the base civil engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams and/or as-built drawings for the facility.

Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate.

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

Designated Local Utility Locating Service

Contact your designated local utility locating service (e.g., Dig-Safe, Blue Stake, One Call) to identify and mark the location of utilities. Call 811 in the US or go to www.call811.com to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions.

Independent Field Survey (Utility Locate)

The organization conducting the intrusive work (CH2M HILL or subcontractor) shall arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility locating service.

The independent field survey provider shall determine the most appropriate instrumentation/technique or combinations of instrumentation/techniques to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A CH2M HILL or subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to resurvey the area. Obtain documentation of the survey and clearances in writing that are signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, CH2M HILL or the subcontractor shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations

- Having qualified staff available and instrumentation to conduct the locate
- Agreeing to document the survey and clearances in writing
- Should any of the above criteria not be met, CH2M HILL or subcontractor must arrange for an alternate independent utility locate service to perform the survey.
- The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SC, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

Visual Assessment before and during Intrusive Activities

Perform a “360 degree” assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

The visual survey shall include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by nonaggressive means such as air or water knifing, hand digging, or human powered hand augering. Nonconductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by nonaggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

Intrusive Activities within 2 feet of an Underground Utility

Use nonaggressive methods (hand digging, vacuum excavation, etc.) to perform intrusive activities within 2 feet of a high risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair/replace). Hazardous utilities shall be de-energized whenever possible.

Spotter

A spotter shall be used to monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, refusal of auger or excavating equipment). If any suspicious conditions are encountered, stop work immediately and contact the PM or RHSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (e.g., air horn, hand signals).

9.20 Utilities (overhead)

Proximity to Power Lines

No work is to be conducted within 50 feet (15.2 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15.2 meters) of overhead power lines without first making this determination.

Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10 (3.0)
51-100	12 (3.7)
101-200	15 (4.6)
201-300	20 (6.1)
301-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

- The power line(s) has been isolated through the use of insulating blankets that have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

9.21 Visible Lighting

Lighting shall be evaluated when conducting work inside buildings, confined spaces, or other areas/instances where supplemental light may be needed (e.g., work before sunrise or after sunset). A light meter can be used to evaluate the adequacy of lighting. The following are common requirements for lighting and the conditions/type of work being performed.

- While work is in progress outside construction areas shall have at least 33 lux.
- Construction work conducted inside buildings should be provided with at least 55 lux light.
- The means of egress shall be illuminated with emergency and nonemergency lighting to provide a minimum 11 lux measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

9.22 Working Around Material Handling Equipment

When CH2M HILL personnel are exposed to material handling equipment, the following safe work practices/hazard controls shall be implemented:

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers and equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

10.0 Physical Hazards and Controls

10.1 Noise

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

CH2M HILL is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90 dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- In areas or around equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 84 dBA or a noise dose of 50 percent must participate in the hearing conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online noise training module located on CH2M HILL's VO.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner.

10.2 Ultraviolet Radiation (sun exposure)

Health effects regarding ultraviolet (UV) radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer. Implement the following controls to avoid sunburn.

Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).

- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
 - Fabrics such as canvas, sailcloth, awning material, and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or “Foreign Legion” style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Reapply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off nonwaterproof products.
- Check for expiration dates because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- No sunscreen provides 100 percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

10.3 Temperature Extremes

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes (see following sections)
- Communicating any concerns regarding heat and cold stress to their supervisor or SC

10.3.1 Heat

Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is the degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions. Acclimatization affects their ability to do work. Acclimatized individuals sweat sooner and more profusely than unacclimatized individuals. Acclimatization occurs gradually over 1 to 2 weeks of continuous exposure, but it can be lost in as little as 3 days in a cooler environment.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool—but not cold—water. Call ambulance, and get medical attention immediately!

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50 degree Fahrenheit (°F) (10 degrees Celsius [°C]) to 60 °F (15.6 °C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (do not begin with extremely demanding activities).

- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. PREVENTION and communication is key.

Thermal Stress Monitoring

The following procedures should be implemented when the ambient air temperature exceeds 70° F (21 °C), the relative humidity is high (greater than 50 percent), or when the workers exhibit symptoms of heat stress.

- The heart rate should be measured by the radial pulse for 30 seconds, as early as possible in the resting period.
- The heart rate at the beginning of the rest period should not exceed 110 beats per minute or 20 beats per minute above resting pulse.
- If the heart rate is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 110 beats per minute, or 20 beats per minute above resting pulse.
- Alternately, the oral temperature can be measured before the workers have something to drink.
- If the oral temperature exceeds 99.6 °F (37.6 °C) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral temperature is maintained below 99.6 °F (37.6 °C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field.

Procedures for when Heat Illness Symptoms are Experienced

- **Always** contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a CH2M HILL worker, contact the immediate supervisor.

- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow precautions under the emergency medical treatment of this HSP.
- Follow the Incident Notification, Reporting, and Investigation section of this HSP.

10.3.2 Cold

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

Noninsulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-chill index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC guidelines for work and warm-up schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor or PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Rewarm area quickly in warm—but not hot—water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

$T_{air} (^{\circ}C)$												
V_{10} (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

Notes

T_{air} = Actual Air Temperature in $^{\circ}C$

V_{10} = Wind Speed at 10 meters in km/h (as reported in weather observations)

11.0 Biological Hazards and Controls

Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the immediate supervisor.

11.1 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or a buddy. If you are stung, contact the worker's immediate supervisor. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

11.2 Bird Droppings

Large amounts of bird droppings may present a disease risk. The best way to prevent exposure to fungus spores in bird droppings is to avoid disturbing it. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease.

If disturbing the droppings or if removal is necessary to perform work, follow these controls:

- Use dust control measures (wetting with water or HEPA vacuuming) for all activities that may generate dust from the accumulated droppings.
- Wear Tyvek® with hoods, disposable gloves and booties, and air-purifying respirators with a minimum N95 rating.
- Put droppings into plastic/poly bags and preferably into a 55-gallon drum to prevent bag from ripping.

11.3 Coyotes

While far from domesticated, coyotes show little fear of humans and have become comfortable living in close proximity to our communities. Although they tend to do most of their hunting after dusk, coyotes can be active at any time. Under normal circumstances, a coyote is not a danger to humans. They are, however, territorial and will respond aggressively if they or their family are threatened.

If you encounter a coyote that behaves aggressively, you have probably gotten too close to its prey or its family. Try to scare the coyote by yelling and waving your arms. Throw rocks, sticks or other objects. Do not turn away and run.

11.4 Feral Dogs

Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies. If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare. If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you have reached safety (e.g. vehicle). If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to

the ground, curl into a ball with your hands over your head and neck and protect your face. If bitten, contact the worker's immediate supervisor. Report the incident to the local authorities.

11.5 Mosquito Bites

Because of the recent detection of the West Nile Virus in the southwestern United States, it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent:

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or N,N-diethyl-meta-toluamide (DEET) since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35 percent DEET. Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3 to 15 days.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the worker's immediate supervisor.

11.6 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but plants lose its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol, a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems, and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

Poison Ivy



Poison Sumac



Poison Oak



Contamination with poison ivy, sumac, or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed)
- Contact with clothing that has been contaminated with the oil
- Contact from removing shoes that have been contaminated (shoes are coated with urushiol oil)
- Sitting in a vehicle that has become contaminated
- Contact with any objects or tools that have become contaminated
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing

If you must work on a site with poison ivy, sumac, or oak the following precautions are necessary:

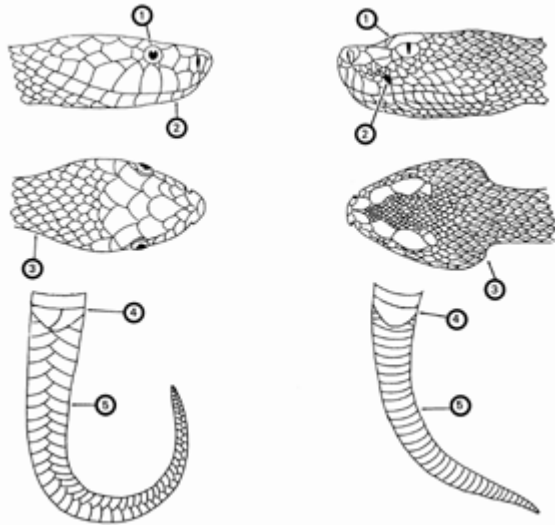
- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac, or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.
- All tools used in the poison ivy, sumac, or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If onsite decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.
- PPE, including Tyvek® coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- As soon as possible following the work, shower to remove any potential contamination. Any body part with suspected or actual exposure should be washed with Zanol, Tecnu or other product designed for removing urushiol. If you do not have Zanol or Tecnu wash with cold water. Do not take a bath, as the oils can form an invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy, and sumac contamination. Check with the closest CH2M HILL warehouse to see if these products are available. Follow all directions for application.

If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor.

11.7 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Call the worker's immediate supervisor immediately. Do not apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings. Below is a guide to identifying poisonous snakes from nonpoisonous snakes.

Identification of Poisonous Snakes

Major Identification Features Nonvenomous Snake	Major Identification Features Venomous Snake
<ol style="list-style-type: none">1. Round pupils2. No sensing pit3. Head slightly wider than neck4. Divided anal plate5. Double row of scales on the underside of the tail	<ol style="list-style-type: none">1. Elliptical pupils2. Sensing pit between eye and nostril3. Head much wider than neck4. Single anal plate5. Single scales on the underside of the tail
	

11.8 Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in the United States. It varies in size in shape, but the distinguishing mark is the violin shape on its body. They are typically nonaggressive. Keep an eye out for irregular, patternless webs that sometimes appear almost tubular built in a protected area such as in a crevice or between two rocks. The spider will retreat to this area of the web when threatened.

The Black Widow, Red Widow, and the Brown Widow are all poisonous. Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day.

Hazard Controls

- Inspect or shake out any clothing, shoes, towels, or equipment before use.
- Wear protective clothing such as a long-sleeved shirt and long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials.
- Minimize the empty spaces between stacked materials.
- Remove and reduce debris and rubble from around the outdoor work areas.
- Trim or eliminate tall grasses from around outdoor work areas.
- Store apparel and outdoor equipment in tightly closed plastic bags.
- Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores.

If you think you have been bit by a poisonous spider, immediately call your immediate supervisor and follow the guidance below:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood.
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite.
- Elevate the bitten area, if possible.
- Do not apply a tourniquet. Do not try to remove venom.
- Try to positively identify the spider to confirm its type. If the spider has been killed, collect it in a plastic bag or jar for identification purposes. Do not try to capture a live spider—especially if you think it is a poisonous spider.

Black Widow



Red Widow



Brown Widow



Brown Recluse



11.9 Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch (6.4 millimeters) in size.

In some geographic areas exposure is not easily avoided. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permethrin and spray skin with only DEET; and check yourself frequently for ticks.

Where site conditions (vegetation above knee height, tick endemic area) or when tasks (e.g., having to sit or kneel in vegetation) diminish the effectiveness of the other controls mentioned above, bug-out suits (check with your local or regional warehouse) or Tyvek® shall be used. Bug-out suits are more breathable than Tyvek®.

Take precautions to avoid exposure by including preplanning measures for biological hazards prior to starting field work. Avoid habitats where possible, reduce the abundance through habitat disruption or application of acaricide. If these controls aren't feasible, contact your local or regional warehouse for preventative equipment such as repellants, protective clothing, and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See the tick fact sheet attached to this HSP for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet.

Be aware of the symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme disease is a rash that might appear that looks like a bullseye with a small welt in the center. RMSF is a rash of red spots under the skin 3 to 10 days after the tick bite. In both RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact your medical provider, human resources representative, supervisor, and health and safety manager.

Be sure to complete an incident report (use the Hours and Incident Tracking System [HITS] system on the VO) if you do come in contact with a tick.

12.0 Contaminants of Concern (COC)

The table below summarizes the potential contaminants of concern (COC) and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). These concentrations were used to determine engineering and administrative controls described in the “Project-Specific Hazard Controls” section of this HSP, as well as PPE and site monitoring requirements.

Contaminants of Concern					
Contaminant	Location and Maximum ^a Concentration (ppm)	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
Asbestos	Unknown	0.1f/cc	NL	Asbestosis (chronic exposure): dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function	NA
Cadmium	Unknown	0.005 mg/m ³	9 mg/m ³ CA	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Chromium (as Cr(II) & Cr(III))	Unknown	0.5 mg/m ³	25 mg/m ³	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Lead	GW: SB: SS:	0.05 mg/m ³	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
PCBs (Limits as Aroclor 1254)	GW: SB: SS:	0.5 mg/m ³	5 CA	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK
Zinc oxide	Unknown	2 mg/m ³	500 mg/m ³	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough	NA

Footnotes:

^a Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).

^b Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (TLV) listed.

^c IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

^d PIP = photoionization potential; NA = Not applicable; UK = Unknown.

eV = electron volt

mg/kg = milligram per kilogram

mg/m³ = milligrams per cubic meter

ug/m³ = micrograms per cubic meter

Potential Routes of Exposure		
Dermal: Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls, and proper use of PPE.	Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls, and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.	Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

13.0 Site Monitoring

(Reference CH2M HILL SOP HSE-207, *Exposure Monitoring for Airborne Chemical Hazards*)

When performing site monitoring, record all the information, such as in a field logbook. Note date and time, describe monitoring location (for example, in breathing zone, at source and site location), and what the reading is. If any action levels are reached, note it in the field logbook and note the action taken.

Exposure records (air sampling) must be preserved for the duration of employment plus 30 years. Ensure that copies of the field log book are maintained in the project file.

Copies of all project exposure records (e.g., copies of field logbook pages where air monitoring readings are recorded and associated calibration) shall be sent to the regional SPA for retention and maintained in the project files.

13.1 Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels ^a	Action to be Taken when Action Level reached	Frequency ^b	Calibration
					Daily
					Daily
					Daily
					Daily
					Daily
Dust Monitor: Visual	All	No visual dust mg/m ³ visual dust mg/m ³	Level D Level C/engineering controls	continuous	NA
					Not applicable
					Daily
					Daily

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the SC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.

^c If the measured percent of O₂ is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O₂ action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O₂ action levels are required for confined-space entry.

^d Noise monitoring and audiometric testing also required.

13.2 Calibration Specifications

13.3 Reserved Integrated Personal Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the RHSM immediately if these contaminants are encountered.

Method Description

NA during this initial SOW

Personnel and Areas

Results must be sent immediately to the RHSM. Regulations may require reporting to monitored personnel. Results reported to:

RHSM:

Other:

14.0 Personal Protective Equipment (PPE)

(Reference CH2M HILL- SOP HSE-117, *Personal Protective Equipment*)

14.1 Required PPE

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.

A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM that approved this plan. Below are items that need to be followed when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area.
- Areas requiring PPE should be posted, or employees must be informed of the requirements in an equivalent manner.
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage.
- PPE must be maintained in a clean and reliable condition.
- Damaged PPE shall not be used and must either be repaired or discarded.
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the RHSM so this table can be updated.

Project-Specific Personal Protective Equipment Requirements ^a				
Task	Level	Body	Head	Respirator ^b
Site Walk Lead Investigation (XRF)	D	Work clothes; safety toed leather work boots and gloves	Hardhat ^c Safety glasses with side shields Ear protection ^d	None required
Lead Investigation – destructive sample collection	Modified D	Coveralls: regular coveralls Boots: Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile	Hardhat ^c Splash shield ^c Safety glasses with side shields Ear protection ^d	None required.
Work near vehicular traffic ways or earth moving equipment.	All	Appropriate level of ANSI/ISEA 107-2004 high-visibility safety vests.	Work near vehicular traffic ways or earth moving equipment.	
Equipment decontamination if using pressure washer	Modified D with splash protection	Coveralls: Polycoated Tyvek® Boots: 16-inch-high steel-toed rubber boots Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Splash shield ^c over safety glasses with side shields or splash goggles Ear protection ^d	None required.

Project-Specific Personal Protective Equipment Requirements ^a				
Task	Level	Body	Head	Respirator ^b
Asbestos Investigation	C	Coveralls: Tyvek® Boots: Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Splash shield ^c Ear protection ^d Spectacle inserts Eye protection (1/2 face resp)	APR, 1/2 face, or MSA Ultratwin or equivalent; GMC-H ^e .

Reasons for Upgrading or Downgrading Level of Protection (with approval of the RHSM)	
Upgrade ^f	Downgrade
<ul style="list-style-type: none"> Request from individual performing tasks Change in work tasks that will increase contact or potential contact with hazardous materials Occurrence or likely occurrence of gas or vapor emission Known or suspected presence of dermal hazards Instrument action levels in the "Site Monitoring" section exceeded 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought Change in site conditions that decrease the hazard Change in work task that will reduce contact with hazardous materials
^a Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees. ^b No facial hair that would interfere with respirator fit is permitted. APR – air purifying respirator ^c Hardhat and splash-shield areas are to be determined by the SC. ^d Ear protection should be worn when conversations cannot be held at distances of 3 feet (1 meter) or less without shouting. ^e See cartridge change-out schedule. ^f Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and an SC qualified at that level is present.	

14.2 Respiratory Protection

(Reference CH2M HILL SOP HSE-121, *Respiratory Protection*)

Implement the following when using respiratory protection:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for APR use and Level B training is required for supplied-air respirators, and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR).
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used.
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months.
- Respirator use shall be limited to those activities identified in this plan. If a change in site conditions change alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan.
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use.

- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade.
- Respirators in regular use shall be inspected before each use and during cleaning.
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition.
- Respirators shall be properly stored to protect against contamination and deformation.
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service.
- When breathing air is supplied by cylinder or compressor, the SC or RHSM shall verify the air meets Grade D air specifications.
- The SC or designee shall complete the health and safety self-assessment checklist – respiratory protection included in as attachment to this plan to verify compliance with CH2M HILL’s respiratory protection program.

Respirator Change-Out Schedule

Contaminant	Change-Out Schedule
Asbestos	End of shift

15.0 Worker Training and Qualification

15.1 CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, *Training*)

15.1.1 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

15.1.1.1 Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with 29 CFR 1910.120.

15.1.1.2 Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received 3 days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

15.1.1.3 Refresher Training

General site workers and treatment, storage, and disposal workers shall receive 8 hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

15.1.1.4 Eight-Hour Supervisory Training

Onsite management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing such operations. Employees designated as Safety Coordinator – Hazardous Waste are considered 8-hour HAZWOPER Site Safety Supervisor trained.

15.1.2 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the American Red Cross Association or National Safety Council shall be administered by a certified trainer. A minimum of two personnel per active field operation will have first aid and CPR training. Bloodborne pathogen training located on CH2M HILL's VO is also required for those designated as first aid/CPR trained.

15.1.3 Safety Coordinator Training

SCs are trained to implement the HSE program on CH2M HILL field projects. A qualified SC is required to be identified in the site-specific HSP for CH2M HILL field projects. SCs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SCs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection, excavation).

15.1.4 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed site-specific training that will address the contents of applicable HSPs, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. This training allows field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

15.1.5 Project-Specific Training Requirements

Project-specific training for this project includes:

- HSPs/ AHAs
- Lead/ Asbestos awareness (CH2M HILL staff)
- ACM state certification – sample collection
- HAZWOPER
- Lead Risk Assessor license and training
- XRF training

16.0 Medical Surveillance and Qualification

All site workers participating in hazardous waste operations or emergency response will maintain an adequate medical surveillance program in accordance with 29 CFR 1910.120 or 29 CFR 1926.65 and other applicable OSHA standards. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

16.1 Hazardous Waste Operations and Emergency Response

CH2M HILL personnel expected to participate in onsite hazardous waste operations or emergency response are required to have a current medical qualification for performing this work. Medical qualification shall consist of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site, including any recommended limitations on the employee's assigned work. The physician's written opinion shall state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

16.2 Job or Site-Specific Medical Surveillance

Due to the nature of hazards for a particular job or work site, specialized medical surveillance may be necessary. This surveillance could include biological monitoring for specific compounds, or specialized medical examinations.

Site-specific medical surveillance includes:

- Lead
- Asbestos

16.3 Respirator User Qualification

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification shall consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134.

16.4 Hearing Conservation

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 and exposed to noise levels in excess of the 85dBA time-weighted average shall be included in a hearing conservation program that includes annual audiometric testing.

17.0 Site-Control Plan

17.1 Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SC will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
 - Line-of-sight and hand signals
 - Air horn
 - Two-way radio or cellular telephone, if available
- Establish offsite communication.
- Establish and maintain the “buddy system” unless approval is obtained from PM/HSM for use of lone worker program.

17.2 Remediation Work Area Zones

(Reference CH2M HILL SOP HSE-218 *Hazardous Waste Operations*)

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

17.2.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

17.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools,

and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

17.2.3 Exclusion Zone

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed. No eating, smoking or drinking is permitted while in the EZ.

17.2.4 Other Controlled Areas

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape, or rope) as necessary and posted with appropriate signage.

18.0 Decontamination

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. The SC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SC must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking.

18.1 Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination.
- Do not directly handle or touch contaminated materials.
- Make sure there are no cuts or tears in PPE.
- Fasten all closures in suits and cover them with duct tape, if appropriate.
- Take particular care to protect any skin injuries.
- Stay upwind of airborne contamination, where possible.
- Do not eat or drink in contaminated work areas.
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas.
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work.
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated.
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary.
- Minimize the amount of tools and equipment necessary in contaminated areas.

18.2 Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned and decontaminated when it is brought out of the EZ.

18.3 Decontamination during Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

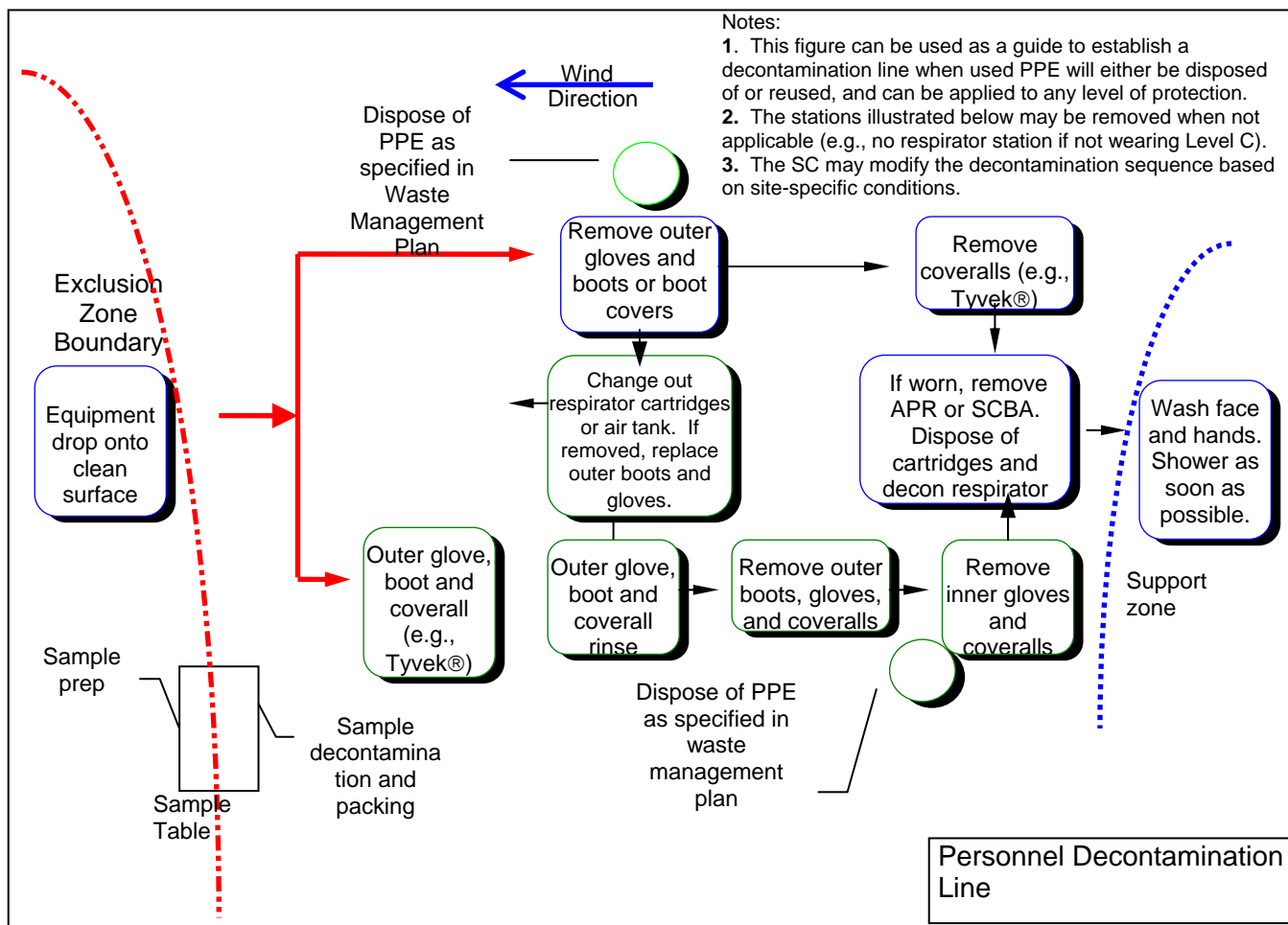
Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

18.4 Waste Collection and Disposal

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, and sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the project plans.

18.5 Diagram of Personnel-Decontamination Line

The following figure illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC to accommodate task-specific requirements.



19.0 Emergency Response Plan

(Reference CH2M HILL SOP HSE-106, *Emergency Planning*)

19.1 Pre-Emergency Planning

- The Emergency Response Coordinator (ERC), typically the SC or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate. Pre-emergency planning activities performed by the ERC include:
- Review the facility emergency and contingency plans, where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post the “Emergency Contacts” page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated.
- Field Trailers: Post “Exit” signs above exit doors, and post “Fire Extinguisher” signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital. Drills should take place periodically but no less than once a year.
- Brief new workers on the emergency response plan.
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

19.2 Emergency Equipment and Supplies

The ERC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	Field Vehicle
First-aid kit	Field Vehicle
Eye Wash	Field Vehicle
Potable water	Field Vehicle
Bloodborne-pathogen kit	Field Vehicle
Additional equipment (specify):Cell Phone	FTL/SSC

19.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel.
- Shut down CH2M HILL operations and evacuate the immediate work area.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.
- Implement HSE-111, Incident Notification, Reporting, and Investigation.
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in the “Incident Notification, Reporting, and Investigation” section of this HSP.

19.4 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing/heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in the “Emergency Contacts” page located in this section.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee, the supervisor will call the worker’s immediate supervisor and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the serious incident reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to this HSP.
- Notify and submit reports to client as required in contract.

19.5 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.

- The ERC and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in the “Incident Notification, Reporting, and Investigation” section of this HSP.

19.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency—help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

19.7 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop--seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area.
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers.
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding.
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands.
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped/restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should

be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

Emergency Contacts

24-hour CH2M HILL Serious Incident Reporting Contact – 720-286-4911

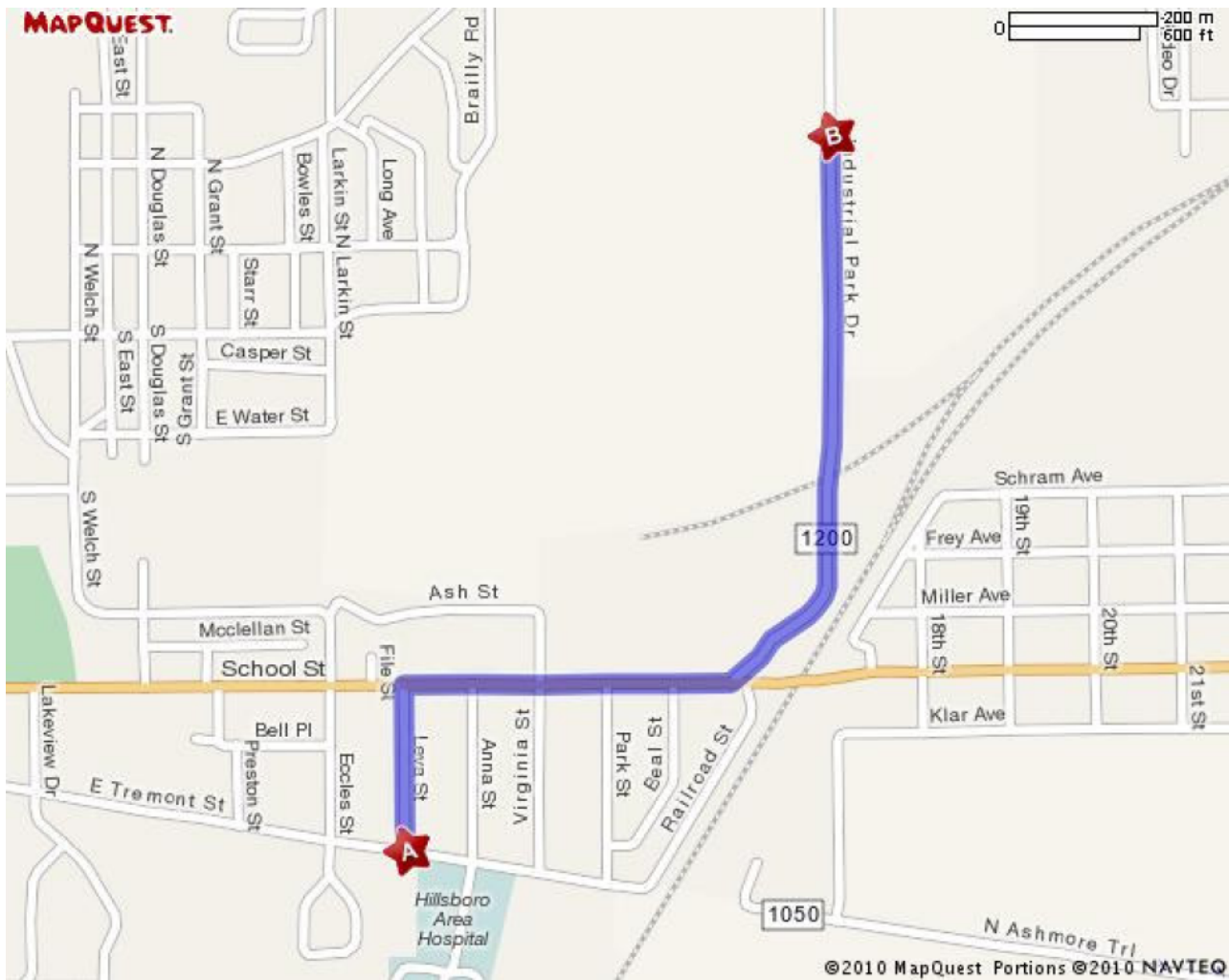
Medical Emergency – 911 Facility Medical Response #:911 Local Ambulance #:911	CH2M HILL- Medical Consultant WorkCare Dr. Peter Greaney M.D. 300 S. Harbor Blvd, Suite 600 Anaheim , CA 92805 800-455-6155 714-978-7488
Fire/Spill Emergency – 911 Facility Fire Response #: 911 Local Fire Dept #: 911	CH2M HILL Director – Health, Safety, Security & Environment Andy Strickland/DEN (720) 480-0685 (cell) or (720) 286-2393 (office)
Security & Police – 911 Facility Security #: 911 Local Police #: 911	CH2M HILL Responsible Health and Safety Manager (RHSM) Name: Mark Orman Phone: 414-712-4138
Utilities Emergency Phone Numbers Water: 1811 Gas: 1811 Electric: 1811	Env. Compliance Mgr. Name: Terri Gerrish Phone: 973-632-0238
CH2M HILL Project Manager Name: Lisa Cundiff Phone: 618-610-6120	CH2M HILL Worker’s Compensation: Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: (720) 891-5382
CH2M HILL Safety Coordinator (SC) Name: Wayne Conway Phone: 314-971-7507	Media Inquiries Corporate Strategic Communications Name: John Corsi Phone: (720) 286-2087
CH2M HILL Project Environmental Manager Name: Phone:	Automobile Accidents Rental: Jennifer Rindahl/DEN: 720-286-2449 CH2M HILL owned vehicle: Linda George/DEN: 720-286-2057
Federal Express Dangerous Goods Shipping Phone: 800/238-5355	CHEMTEL (hazardous material spills) Phone: 800/255-3924
Facility Alarms: None	Evacuation Assembly Area(s):
Facility/Site Evacuation Route(s):	

Directions to Local Hospital

Local Hospital:

Hillsboro Area Hospital
1200 East Tremont Street
Hillsboro, IL 62046
(217) 532- 6111

1. Depart CR-1200 E / Industrial Park Dr toward SR-16 / School St - 0.7 miles
2. Bear right onto SR-16 / School St - 0.3 miles
3. Turn left onto Anna St - 0.2 miles
4. Turn right onto E Tremont St - 0.1 miles
5. Arrive



20.0 Spill Containment Procedures

CH2M HILL and subcontractor personnel working at the project site shall be knowledgeable of the potential HSE concerns associated with petroleum and other substances that could potentially be released at the project site.

The following is a list of criteria that must be addressed in CH2M HILL's or the subcontractor's plans in the event of a spill or release. In the event of a large quantity spill notify emergency services. Personnel discovering a spill shall (only if safe to do so):

- Stop or contain the spill immediately (if possible) or note source. Shut off the source (e.g., pump, treatment system) if possible. If unsafe conditions exist, then leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. The SC shall be notified immediately.
- Extinguish sources of ignition (flames, sparks, hot surfaces, cigarettes).
- Clear personnel from the spill location and barricade the area.
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread.
- Use sorbent materials to control the spill at the source.
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks, or other suitable materials to help contain the spill.
- Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified;
- Assess possible hazards to human health or the environment as a result of the release, fire, or explosion
- Follow the incident notification, reporting, and investigation section of this plan.

21.0 Inspections

21.1 Project Activity Self-Assessment Checklists

In addition to the hazard controls specified in this document, project activity self-assessment checklists are contained as an attachment to this HSP. The project-activity self-assessment checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

The self-assessment checklists will also be used by the SC in evaluating the subcontractors and any client contractors' compliance onsite.

The self-assessment checklists for the following tasks and exposures are required when the task or exposure is initiated and weekly thereafter while the task or exposure is taking place. The checklists shall be completed by the SC or other CH2M HILL representative and maintained in project files.

- Hand and power tools
- Electrical safety
- LO/TO
- Respiratory protection
- Hazardous materials handling
- PPE

21.2 Safe Behavior Observations

Safe Behavior Observations (SBOs) are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss.

The SC or designee shall complete the SBO form (attached to this HSP) weekly. They shall be electronically submitted weekly by e-mailing them to the address [CH2M HILL ES FED Safe Behavior Observation](#).

22.0 Incident Notification, Reporting, and Investigation

(Reference CH2M HILL SOP HSE-111, *Incident Notification, Reporting and Investigation*)

22.1 General Information

This section applies to the following:

- All injuries involving employees, third parties, or members of the public
- Damage to property or equipment
- Interruptions to work or public service (e.g., hitting a utility)
- Incidents which attract negative media coverage
- Near misses
- Spills, leaks, or regulatory violations
- Motor vehicle accidents

Documentation, including incident reports, investigation, analysis, and corrective measure taken, shall be kept by the SC and maintained onsite for the duration of the project.

22.2 Section Definitions

Incident: An undesired event that results or could have resulted in loss through injury, damage to assets, or environmental harm. This includes all of the definitions below.

Accident: An incident involving actual loss through injury, damage to assets, or environmental harm.

Near Miss: An unsafe act or incident that, in other circumstances, could have resulted in loss through injury, damage to assets, or environmental harm.

Serious Incident:

- All fatalities including contractors, subcontractors, third parties, or members of the public
- Kidnap/missing person
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$ 500,000 in damage
- Acts or threats of terrorism
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community, or the environment

22.3 Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident (including "near misses," as defined in the section above) in which they are involved or witness to their supervisor.

The CH2M HILL or subcontractor supervisor, upon receiving an incident report, shall inform his immediate superior and the CH2M HILL SC.

The SC shall immediately report the following information to the RHSM and PM by phone and e-mail:

- Project name/site manager
- Date and time of incident
- Description of incident
- Extent of knowledge injuries/damage
- Level of medical attention
- Preliminary root cause/corrective actions

The SC shall complete an entry into the HITS database system located on CH2M HILL's VO (or if VO not available, use the hard copy IRF and root cause analysis form and forward it to the RHSM) within 24 hours and finalize those forms within 3 calendar days.

The CH2M HILL team shall comply with all applicable statutory incident reporting requirements such as those to OSHA and the police.

22.4 HITS System and Incident Report Form (IRF)

It is the policy of CH2M HILL to maintain a HITS entry and/IRF for all work-related injuries and illnesses sustained by its employees in accordance with recordkeeping and insurance requirements. A HITS entry and/or IRF will also be maintained for other incidents (property damage, fire or explosion, spill, release, potential violation, and near misses) as part of our loss prevention and risk reduction initiative.

22.5 Serious Incident Reporting Requirements

(Reference CH2M HILL SOP HSE-111, *Incident Reporting, Notification and Investigation*)

The serious incident reporting requirements ensures timely notification and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates Health, Safety, Security and Environment (HSSE) and Firm Wide Security Operations (FWSO) requirements for the consistent reporting of and managing of serious events throughout our operations.

22.5.1 Serious Incident Determination

The following are general criteria for determining whether an incident on CH2M HILL owned or managed facilities or program sites is considered serious and must be immediately reported up to group president level through the reporting/notification process:

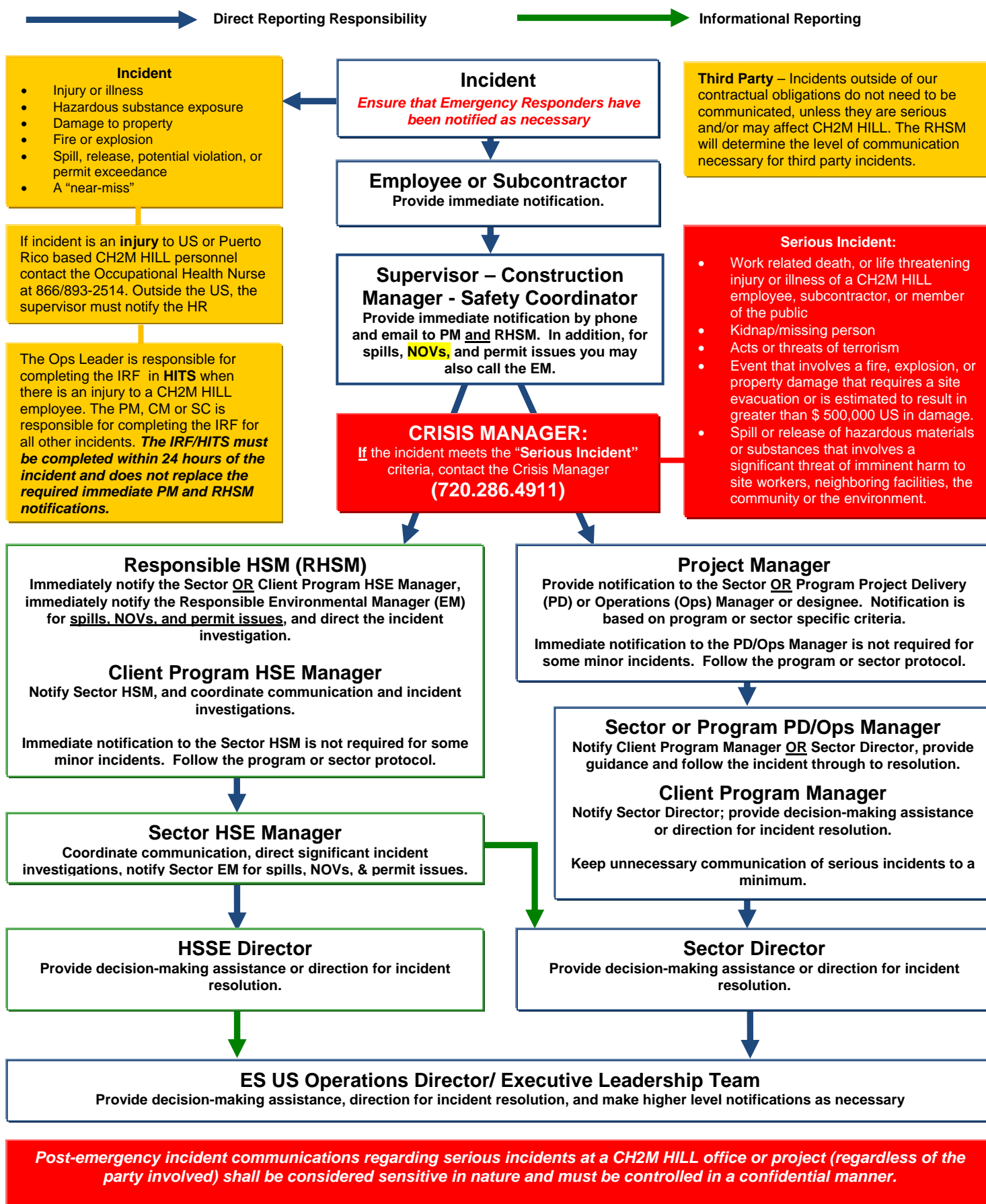
- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public
- Kidnap/missing person
- Acts or threats of terrorism
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$ 500,000 in damage
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community, or the environment

22.5.2 Serious Incident Reporting

If an incident meets the “Serious Incident” criteria, the Project Manager is to immediately contact the Crisis Manager at 720-286-4911, then follow the standard incident reporting procedure.

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team.

ESBG US Operations Incident Reporting Flow Diagram



22.6 Incident Root Cause Analysis

The accident analysis is essential if all causes of the incident are to be identified for the correct remedial actions to be taken to prevent the same and similar type of incident from recurring. The investigation team will consist of the SC (with support from RHSM), appropriate subcontractor personnel as necessary, the PM, and the responsible supervisor. More participants may be involved as needed to complete the investigation.

The root cause analysis form must be completed for all loss incidents and near loss incidents. This form must be submitted to the investigation team for review.

For minor losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, determine the root cause, and develop recommendations. More complex situations may require the investigation team to revisit the loss site or reinterview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must use the root cause analysis flow chart to assist in identifying the root cause(s) of a loss. Any loss may have one or more root causes and contributing factors. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the person involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors." Causes that pertain to the system within which the loss or injury occurred should be referred to as "job factors."

22.6.1 Personal Factors

- Lack of skill or knowledge
- Correct way takes more time and/or requires more effort
- Short-cutting standard procedures is positively reinforced or tolerated
- Person thinks there is no personal benefit to always doing the job according to standards

22.6.2 Job Factors

- Lack of or inadequate operational procedures or work standards
- Inadequate communication of expectations regarding procedures or standards
- Inadequate tools or equipment

The root cause(s) could be any one or a combination of these seven possibilities or some other uncontrollable factor. In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.

22.6.3 Corrective Actions

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a timeframe for completion. Be sure the corrective actions address the causes.

Once the investigation report has been completed, the PM shall hold a review meeting to discuss the incident and provide recommendations. The responsible supervisors shall be assigned to carry out the recommendations, and shall inform the SC upon successful implementation of all recommended actions.

- The RHSM will inform the Responsible Environmental Manager (REM) of any environmental incidents.
- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, REM, or FWSO. The business group HSE Lead will review all business group incidents and modify as required.
- Incident investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.

23.0 Records and Reports

An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other CH2M HILL employees can easily and quickly find documents.
- Records are readily available for review.
- Records may be needed during OSHA investigations, audits, or other legal matters.
- Records may be needed on short notice in case of an accident, illness or other emergency.
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with CH2M HILL's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SC are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), MSDSs, exposure modeling results.
- Physical hazard exposure records include noise, ionizing radiation, nonionizing radiation, vibration, and lasers exposure assessments, and measurements.
- Respiratory fit test records
- Training records
- Injury/illness reports and investigations
- Federal or state agency inspection records
- Other Records
 - Ergonomic evaluations
 - HSE audits and assessments
 - Project-Specific HSE Plans
 - Confined Space Entry Permits
 - Equipment inspections
 - Equipment maintenance
 - SBOs
 - Self-assessment checklists

CH2M HILL Health and Safety Plan

Attachment 1

Health and Safety Plan Employee Sign-off Form

Health and Safety Plan

Project Name:

EMPLOYEE NAME

EMPLOYEE SIGNATURE

COMPANY

DATE _____

[illegible]

CH2M HILL Health and Safety Plan

Attachment 2

Chemical Inventory/Register Form

CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP HSE-107, Attachment 1, for instructions on completing this form.

Location:

HCC:

☐ Office

☐ Warehouse

☐ Laboratory

☐ Project:

Project No.:

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)

MSDS for the listed products will be maintained at:

CH2M HILL Health and Safety Plan

Attachment 3

Chemical-Specific Training Form

CHEMICAL-SPECIFIC TRAINING FORM

Refer to SOP HSE-107 Attachment 1 for instructions on completing this form.

Location:

Project # :

HCC:

Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance, or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

CH2M HILL Health and Safety Plan

Attachment 4

Project Activity Self-Assessment Checklists/Permits/Forms

- Hand and power tools
- Electrical safety
- Lockout/tagout (LO/TO)
- Respiratory protection
- Hazardous materials handling
- Personal protective equipment (PPE)



Pre-Task Safety Plan (PTSP)

Project: _____ Location: _____ Date: _____		
Supervisor: _____ Job Activity: _____ _____		
Task Personnel: _____ _____ _____ _____		
List Tasks: _____ _____ _____ _____		
Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools): _____ _____ _____		
Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check that apply):		
___ Chemical burns/contact	___ Trench, excavations, cave-ins	___ Ergonomics
___ Pressurized lines/equipment	___ Overexertion	___ Chemical splash
___ Thermal burns	___ Pinch points	___ Poisonous plants/insects
___ Electrical	___ Cuts/abrasions	___ Eye hazards/flying projectile
___ Weather conditions	___ Spills	___ Inhalation hazard
___ Heights/fall > 6 feet	___ Overhead Electrical hazards	___ Heat/cold stress
___ Noise	___ Elevated loads	___ Water/drowning hazard
___ Explosion/fire	___ Slips, trip and falls	___ Heavy equipment
___ Radiation	___ Manual lifting	___ Aerial lifts/platforms
___ Confined space entry	___ Welding/cutting	___ Demolition
Other Potential Hazards (Describe): _____ _____ _____ _____ _____		

CH2MHILL

Hazard Control Measures (Check That Apply):			
PPE <input type="checkbox"/> Thermal/lined <input type="checkbox"/> Eye <input type="checkbox"/> Dermal/hand <input type="checkbox"/> Hearing <input type="checkbox"/> Respiratory <input type="checkbox"/> Reflective vests <input type="checkbox"/> Flotation device	Protective Systems <input type="checkbox"/> Sloping <input type="checkbox"/> Shoring <input type="checkbox"/> Trench box <input type="checkbox"/> Barricades <input type="checkbox"/> Competent person <input type="checkbox"/> Locate buried utilities <input type="checkbox"/> Daily inspections	Fire Protection <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire watch <input type="checkbox"/> Non-spark tools <input type="checkbox"/> Grounding/bonding <input type="checkbox"/> Intrinsically safe equipment	Electrical <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Grounded <input type="checkbox"/> Panels covered <input type="checkbox"/> GFCI/extension cords <input type="checkbox"/> Power tools/cord inspected
Fall Protection <input type="checkbox"/> Harness/lanyards <input type="checkbox"/> Adequate anchorage <input type="checkbox"/> Guardrail system <input type="checkbox"/> Covered opening <input type="checkbox"/> Fixed barricades <input type="checkbox"/> Warning system	Air Monitoring <input type="checkbox"/> PID/FID <input type="checkbox"/> Detector tubes <input type="checkbox"/> Radiation <input type="checkbox"/> Personnel sampling <input type="checkbox"/> LEL/O2 <input type="checkbox"/> Other	Proper Equipment <input type="checkbox"/> Aerial lift/ladders/scaffolds <input type="checkbox"/> Forklift/heavy equipment <input type="checkbox"/> Backup alarms <input type="checkbox"/> Hand/power tools <input type="checkbox"/> Crane with current inspection <input type="checkbox"/> Proper rigging <input type="checkbox"/> Operator qualified	Welding & Cutting <input type="checkbox"/> Cylinders secured/capped <input type="checkbox"/> Cylinders separated/upright <input type="checkbox"/> Flash-back arrestors <input type="checkbox"/> No cylinders in CSE <input type="checkbox"/> Flame retardant clothing <input type="checkbox"/> Appropriate goggles
Confined Space Entry <input type="checkbox"/> Isolation <input type="checkbox"/> Air monitoring <input type="checkbox"/> Trained personnel <input type="checkbox"/> Permit completed <input type="checkbox"/> Rescue	Medical/ER <input type="checkbox"/> First-aid kit <input type="checkbox"/> Eye wash <input type="checkbox"/> FA-CPR trained personnel <input type="checkbox"/> Route to hospital	Heat/Cold Stress <input type="checkbox"/> Work/rest regime <input type="checkbox"/> Rest area <input type="checkbox"/> Liquids available <input type="checkbox"/> Monitoring <input type="checkbox"/> Training	Vehicle/Traffic <input type="checkbox"/> Traffic control <input type="checkbox"/> Barricades <input type="checkbox"/> Flags <input type="checkbox"/> Signs
Permits <input type="checkbox"/> Hot work <input type="checkbox"/> Confined space <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Excavation <input type="checkbox"/> Demolition <input type="checkbox"/> Energized work	Demolition <input type="checkbox"/> Pre-demolition survey <input type="checkbox"/> Structure condition <input type="checkbox"/> Isolate area/utilities <input type="checkbox"/> Competent person <input type="checkbox"/> Hazmat present	Inspections: <input type="checkbox"/> Ladders/aerial lifts <input type="checkbox"/> Lanyards/harness <input type="checkbox"/> Scaffolds <input type="checkbox"/> Heavy equipment <input type="checkbox"/> Cranes and rigging	Training: <input type="checkbox"/> Hazwaste <input type="checkbox"/> Construction <input type="checkbox"/> Competent person <input type="checkbox"/> Task-specific (THA) <input type="checkbox"/> Hazcom
Field Notes: _____ _____ _____			

Name (Print): _____

Signature: _____

Date: _____

CH2MHILL

Incident Report Form (Hardcopy)

Type of Incident (Select at least one)

- | | | |
|---|--|--|
| <input type="checkbox"/> Injury/Illness | <input type="checkbox"/> Property Damage | <input type="checkbox"/> Spill/Release |
| <input type="checkbox"/> Environmental/Permit Issue | <input type="checkbox"/> Near Miss | <input type="checkbox"/> Other |

General Information (Complete for incident types)

Preparer's Name: _____ Preparer's Employee Number: _____
Date of Report: _____ Date of Incident: _____ Time of Incident: _____ am/pm

Type of Activity (Provide activity being performed that resulted in the incident)

- | | | |
|---|---|--|
| <input type="checkbox"/> Asbestos Work | <input type="checkbox"/> Excavation Trench-Hazwaste | <input type="checkbox"/> Other (Specify) _____ |
| <input type="checkbox"/> Confined Space Entry | <input type="checkbox"/> Excavation Trench-Non Haz | |
| <input type="checkbox"/> Construction Mgmt- Hazwaste | <input type="checkbox"/> Facility Walk Through | <input type="checkbox"/> Process Safety Management |
| <input type="checkbox"/> Construction Mgmt - Non-Hazwaste | <input type="checkbox"/> General Office Work | <input type="checkbox"/> Tunneling |
| <input type="checkbox"/> Demolition | <input type="checkbox"/> Keyboard Work | <input type="checkbox"/> Welding |
| <input type="checkbox"/> Drilling-Hazwaste | <input type="checkbox"/> Laboratory | <input type="checkbox"/> Wetlands Survey |
| <input type="checkbox"/> Drilling-Non Hazwaste | <input type="checkbox"/> Lead Abatement | <input type="checkbox"/> Working from Heights |
| <input type="checkbox"/> Drum Handling | <input type="checkbox"/> Motor Vehicle Operation | <input type="checkbox"/> Working in Roadways |
| <input type="checkbox"/> Electrical Work | <input type="checkbox"/> Moving Heavy Object | <input type="checkbox"/> WWTP Operation |

Location of Incident (Select one)

- ☐ Company Premises (CH2M HILL Office: _____)
- ☐ Field (Project #: _____ Project/Site Name: _____ Client: _____)
- ☐ In Transit (Traveling from: _____ Traveling to: _____)
- ☐ At Home

Geographic Location of Incident (Select region where the incident occurred)

- | | | |
|------------------------------------|------------------------------------|---|
| <input type="checkbox"/> Northeast | <input type="checkbox"/> Southwest | <input type="checkbox"/> Asia Pacific |
| <input type="checkbox"/> Southeast | <input type="checkbox"/> Corporate | <input type="checkbox"/> Europe Middle East |
| <input type="checkbox"/> Northwest | <input type="checkbox"/> Canadian | <input type="checkbox"/> Latin America |

If a CH2M HILL subcontractor was involved in the incident, provide their company name and phone number:

Describe the Incident (Provide a brief description of the incident): _____

Injured Employee Data (Complete for Injury/Illness incidents only)

If CH2M HILL employee injured

Employee Name: _____ Employee Number: _____

If CH2M HILL Subcontractor employee injured

Employee Name: _____ Company: _____

Injury Type

- | | | |
|--|--|--|
| <input type="checkbox"/> Allergic Reaction | <input type="checkbox"/> Burn/Scald (Heat) | <input type="checkbox"/> Dermatitis |
| <input type="checkbox"/> Amputation | <input type="checkbox"/> Cancer | <input type="checkbox"/> Dislocation |
| <input type="checkbox"/> Asphyxia | <input type="checkbox"/> Carpal Tunnel | <input type="checkbox"/> Electric Shock |
| <input type="checkbox"/> Bruise/Contusion/Abrasion | <input type="checkbox"/> Concussion | <input type="checkbox"/> Foreign Body in eye |
| <input type="checkbox"/> Burn (Chemical) | <input type="checkbox"/> Cut/Laceration | <input type="checkbox"/> Fracture |

- ☐ Freezing/Frost Bite
- ☐ Headache
- ☐ Hearing Loss
- ☐ Heat Exhaustion
- ☐ Hernia
- ☐ Infection
- ☐ Irritation to eye

- ☐ Ligament Damage
- ☐ Multiple (Specify) _____
- ☐ Muscle Spasms
- ☐ Other (Specify) _____

- ☐ Poisoning (Systemic)
- ☐ Puncture
- ☐ Radiation Effects
- ☐ Strain/Sprain
- ☐ Tendonitis
- ☐ Wrist Pain

Part of Body Injured

- ☐ Abdomen
- ☐ Ankle(s)
- ☐ Arms (Multiple)
- ☐ Back
- ☐ Blood
- ☐ Body System
- ☐ Buttocks
- ☐ Chest/Ribs
- ☐ Ear(s)
- ☐ Elbow(s)
- ☐ Eye(s)
- ☐ Face
- ☐ Finger(s)
- ☐ Foot/Feet

- ☐ Hand(s)
- ☐ Head
- ☐ Hip(s)
- ☐ Kidney
- ☐ Knee(s)
- ☐ Leg(s)
- ☐ Liver
- ☐ Lower (arms)
- ☐ Lower (legs)
- ☐ Lung
- ☐ Mind

- ☐ Neck
- ☐ Nervous System
- ☐ Nose
- ☐ Other (Specify) _____
- ☐ Reproductive System
- ☐ Shoulder(s)
- ☐ Throat
- ☐ Toe(s)
- ☐ Upper Arm(s)
- ☐ Upper Leg(s)
- ☐ Wrist(s)

- ☐ Multiple (Specify) _____

Nature of Injury

- ☐ Absorption
- ☐ Bite/Sting/Scratch
- ☐ Cardio-Vascular/Respiratory System Failure
- ☐ Caught In or Between
- ☐ Fall (From Elevation)
- ☐ Fall (Same Level)
- ☐ Ingestion
- ☐ Work Place Violence

- ☐ Inhalation
- ☐ Lifting
- ☐ Mental Stress
- ☐ Motor Vehicle Accident
- ☐ Multiple (Specify) _____
- ☐ Other (Specify) _____

- ☐ Overexertion
- ☐ Repeated Motion/Pressure
- ☐ Rubbed/Abraded
- ☐ Shock
- ☐ Struck Against
- ☐ Struck By

Initial Diagnosis/Treatment Date: _____

Type of Treatment

- ☐ Admission to hospital/medical facility
- ☐ Application of bandages
- ☐ Cold/Heat Compression/Multiple Treatment
- ☐ Cold/Heat Compression/One Treatment
- ☐ First Degree Burn Treatment
- ☐ Heat Therapy/Multiple treatment
- ☐ Multiple (Specify) _____
- ☐ Heat Therapy/One Treatment
- ☐ Non-Prescriptive medicine
- ☐ None
- ☐ Observation
- ☐ Other (Specify) _____
- ☐ Prescription- Multiple dose
- ☐ Prescription- Single dose
- ☐ Removal of foreign bodies

- ☐ Skin Removal
- ☐ Soaking therapy- Multiple Treatment
- ☐ Soaking Therapy- One Treatment
- ☐ Stitches/Sutures
- ☐ Tetanus
- ☐ Treatment for infection
- ☐ Treatment of 2nd /3rd degree burns
- ☐ Use of Antiseptics – multiple treatment
- ☐ Use of Antiseptics – single treatment
- ☐ Whirlpool bath therapy/multiple treatment
- ☐ Whirlpool therapy/single treatment
- ☐ X-rays negative
- ☐ X-rays positive/treatment of fracture

Number of days doctor required employee to be off work: _____

Number of days doctor restricted employee's work activity: _____

Equipment Malfunction : Yes ☐ No ☐ Activity was a Routine Task: Yes ☐ No ☐

Describe how you may have prevented this injury: _____

Physician Information

Name: _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Hospital Information

Name: _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Property Damage (Complete for Property Damage incidents only)

Property Damaged: _____ Property Owner: _____
Damage Description: _____
Estimated Amount: \$ _____

Spill or Release (Complete for Spill/Release incidents only)

Substance (attach MSDS): _____ Estimated Quantity: _____
Facility Name, Address, Phone No.: _____
Did the spill/release move off the property where work was performed?: _____
Spill/Release From: _____ Spill/Release To: _____

Environmental/Permit Issue (Complete for Environmental/Permit Issue incidents only)

Describe Environmental or Permit Issue: _____
Permit Type: _____
Permitted Level or Criteria (e.g., discharge limit): _____
Permit Name and Number (e.g., NPDES No. ST1234): _____
Substance and Estimated Quantity: _____
Duration of Permit Exceedance: _____

Verbal Notification (Complete for incident types)(Provide names, dates and times)

CH2M HILL Personnel Notified: _____
Client Notified: _____

Witnesses (Complete for incident types)**Witness Information (First Witness)**

Name: _____
Employee Number (CH2M HILL): _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Witness Information (Second Witness)

Name: _____
Employee Number (CH2M HILL): _____
Address: _____
City: _____
Zip Code: _____
Phone : _____

Additional Comments: _____

Safe Behavior Observation Form			
<input type="checkbox"/> Federal or <input type="checkbox"/> Commercial Sector (check one)		<input type="checkbox"/> Construction or <input type="checkbox"/> Consulting (check one)	
Project Number:		Client/Program:	
Project Name:		Observer:	Date:
Position/Title of worker observed:		Background Information/ comments:	
Task/Observation _____			
Observed: _____			
<ul style="list-style-type: none"> ❖ Identify and reinforce safe work practices/behaviors ❖ Identify and improve on at-risk practices/acts ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?) ❖ Positive, corrective, cooperative, collaborative feedback/recommendations 			
Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			Positive Observations/Safe Work Practices:
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			Questionable Activity/Unsafe Condition Observed:
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			Observer's Corrective Actions/Comments:
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			Observed Worker's Corrective Actions/Comments:
Other...			

For ES Federal Sector projects please email completed forms to: [CH2M HILL ES FED Safe Behavior Observation](#)
 For ES Commercial Sector projects please email completed forms to: [CH2M HILL ES COM Safe Behavior Observation](#)
 For CNR ES staff please email completed forms to: cnressafe@ch2m.com

Incident & Near-Loss Investigation Report Form

Employer Information

Company Name: _____

Project Name: _____ Task Order: _____

Project Location: _____

Task Location: _____

Job Assignment: _____

Preparer's Name: _____ Preparer's Employee Number: _____

Incident Specific Information

Date of Incident: _____ Time of Incident: _____ A.M./P.M.

Location of incident:

☐ Company premises

☐ Field

☐ In Transit

☐ Other: _____

Address where the incident occurred: _____

Equipment Malfunction : Yes ☐ No ☐

Activity was a Routine Task: Yes ☐ No ☐

Describe any property damage:

Specific activity the employee was engaged in when the incident occurred:

All equipment, materials, or chemicals the employee was using when the incident occurred:

Describe the specific incident and how it occurred:

Describe how this incident may have been prevented:

Contributing Factors (Describe in detail why incident occurred):

Date employer notified of incident: _____ To whom reported:

Witness Information (First Witness)

Name: _____
Employee Number _____
Address: _____
City: _____
Zip Code : _____
Phone: _____

Witness Information (Second Witness)

Name: _____
Employee Number _____
Address: _____
City: _____
Zip Code : _____
Phone: _____

Additional information or
comments: _____

A ROOT CAUSE ANALYSIS FORM MUST BE COMPLETED FOR ALL INJURIES AND ILLNESSES OR ACTUAL LOSSES.

COMPLETION OF THE ROOT CAUSE ANALYSIS FORM FOR NEAR LOSSES IS OPTIONAL, AT THE DISCRETION OF THE HEALTH AND SAFETY MANAGER.

Root Cause Investigation

This attachment is provided to assist in accessing, completing, and reviewing an incident investigation. It is important to remember the following when conducting an investigation:

- Gather relevant facts, focusing on fact-finding, not fault-finding.
- Draw conclusions, pitting facts together into a probable scenario.
- Determine incident root causes, the basic causes why an unsafe act/condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.

Documentation

The following should be included to document the incident.

Description

Provide a description of the event and the sequence of events and actions that took place prior to the incident. Start with the incident event and work backwards in time through all of the preceding events that directly contributed to the incident. The information should identify why the event took place as well as who was involved, when and where the event took place, and what actions were taken.

Cause Analysis

Using the form and flowchart in Attachment 1 the root cause of the incident will be determined. This form must be retained in the project and/or regional HS&E files.

Immediate Causes—List the substandard actions or conditions that directly affected the incident. The following are examples of immediate causes:

Substandard Actions: Operating equipment without authority; failure to warn; failure to secure; operating at improper speed; making safety device inoperable; using defective equipment; failing to use PPE; improper loading; improper lifting; improper position for task; under influence of alcohol or drugs; horseplay.

Substandard Conditions: Exposure to hazardous materials; exposure to extreme temperatures; improper lighting; improper ventilation; congestion; exposure to fire and explosive hazard; defective tools, equipment or materials; exposure to extreme noise; poor ventilation; poor visibility; poor housekeeping.

Basic Causes—List the personal and job factors that caused the incident. The following are examples of basic causes:

Personal Factors: Capability; knowledge; skill; stress; motivation.

Job Factors: Abuse or misuse; engineering; maintenance; purchasing; supervision; tools and equipment; wear and tear; work standards.

Corrective Action Plan

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a time frame for completion. Be sure the corrective actions address the causes. For example, training may prevent recurrence of an incident caused by a lack of knowledge, but it may not help an incident caused by improper motivation.

The following are examples of management programs that may be used to control future incidents. These programs should be considered when determining specific corrective actions.

Management Programs: Accident/incident analysis; emergency preparedness; engineering controls; general promotion; group meetings; health control; hiring and placement; leadership and administration; management training; organizational rules; personal protective equipment; planned inspections; program audits; program controls; purchasing controls; task analysis and procedures; task observation.

Root Cause Analysis Form

Root Cause Analysis (RCA)							
<p>Root Cause Categories (RCC): In the first column, enter the appropriate RCC from the choices below that applies to the root cause (RC) and/or contributing factor (CF) of the incident. Describe the specific root cause and corrective actions in their respective columns.</p> <ol style="list-style-type: none"> 1. Lack of skill or knowledge 2. Lack of or inadequate operational procedures or work standards 3. Inadequate communication of expectations regarding procedures or work standards 4. Inadequate tools or equipment 5. Correct way takes more time and/or requires more effort 6. Shortcutting standard procedures is positively reinforced or tolerated 7. Person thinks there is no personal benefit to always doing the job according to standards 							
RCC #	Root Causes	Corrective Actions	RC ¹	CF ²	Due Date	Completion Date	Date Verified
¹ RC = Root Cause ² CF = Contributing Factors (check which applies)							
Investigation Team Members							
Name		Job Title				Date	
Results of Solution Verification and Validation							
Reviewed By							
Name		Job Title				Date	

CH2M HILL Health and Safety Plan

Attachment 5

Behavior Based Loss Prevention System Forms

Activity Hazard Analysis

Pre-Task Safety Plans

Safe Behavior Observation

Incident Report and Investigation

(use electronic form when possible)

[HITS](#)

EXHIBIT 1 TO FORM 408 HS - ACTIVITY HAZARD ANALYSIS FORM

Activity: Remedial Design Survey of Eagle Zinc site - OU1 Building Demolition	Date: 16-Jun-10	Project: Eagle Zinc in Hillsboro, IL
Description of Services: Sampling for Asbestos containing materials, lead-based paint on non-metal services, dust/wipe for lead and identification of possible mercury containing or PCBs containing equipment.	Site Supervisor: Jose Aguilera	Site Safety Officer: Kristen Templin
Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Control (Develop specific controls for each potential hazard)
Visual Survey of building materials	Be aware of building conditions and do not enter dilapidated buildings or buildings with collapsed or compromised structures. Be aware of slips, trips, and falls. Be aware of unfamiliar surroundings	Be aware of surroundings and use caution. Workers will be trained prior to survey and sampling to address hazards, proper sampling techniques, and proper equipment use. Training certificates will be included in the planning documents. Safety briefings will be held daily.
Sample building materials for asbestos, QC paint chips, dust/wipe of residuals.	Air borne asbestos during sampling. Peeling paint, paint dust, and other dust with lead content.	Use PPE (respirator / dust mask and gloves) for friable sampling, and wet methods for sampling. Use proper knife and tool techniques to prevent hand injury. See HASP. Asbestos is a known carcinogen, and caution should be observed while sampling suspect friable and non-friable materials. A properly fit tested respirator should be worn during sampling of friable asbestos. Sampling techniques are described in the FSP.
Use XRF for direct read analysis of lead in paint	XRF equipment has a radioactive component.	Use XRF analyzer in accordance with manufacturer's instructions. The XRF should only be operator by workers trained, and fully aware of safe practices to prevent exposure.
Using ladders or lifts to collect samples.	Falls that could result in injury.	Use ladders and lifts properly. Take precautions for fall safety. See HASP. Use fall protection when working over 6 feet high. Use tag line to hoist tools.
General site survey activities	Slips, trips, head bumps, inclement weather, safe vehicle practices, and foot injuries are covered in the HASP. Knife blade or sharp hand tool use.	Slips, trips, head bumps, inclement weather, safe vehicle practices, and foot injuries are covered in the HASP. Knife or sharp hand tools should be used with caution and scraped away from the body, change blades when appear dull, wear work gloves when appropriate, handle with care.

**Safe work practices to address general work at construction sites and sampling activities are further described in the HASP.

CH2M HILL Health and Safety Plan

Attachment 6

Material Safety Data Sheets

(Included as material is obtained)

CH2M HILL Health and Safety Plan

Attachment 7

Working Alone Standard

CALL - IN CONTACT FORM

Date of site work:_____ Expected start time:_____

Name of CH2M HILL employee in the field:_____

Name of CH2M HILL employee responsible to receive contact:

Client Emergency Contact (if any):

CH2M HILL employee's contact numbers:

Radio #_____

Cell Phone #_____

Address and Location of work:_____

Directions/Map:

Planned Activity: _____

Specified Frequency and time for call in:_____

Time

Verified

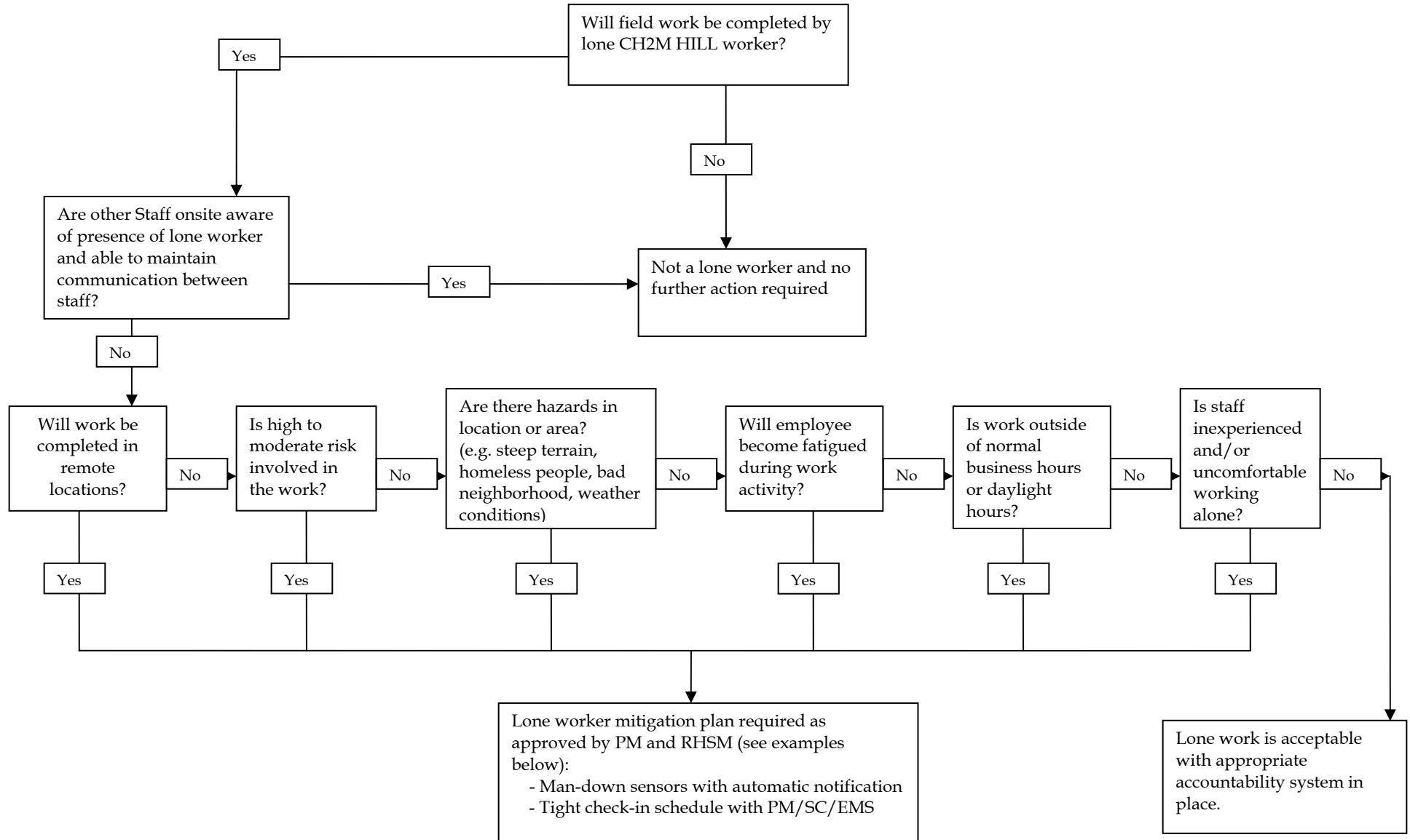
Location

If lone worker fails to call in at specified frequency/time:

- 1) Call worker's radio and cell to determine if an emergency exists.
- 2) If no reply, immediately call Client security/emergency service if there is one at the site.

- 3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency onsite. Provide the lone worker's name, their last known location, and your contact information.
- 4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Responsible Health and Safety Manager.

Lone Worker Protocol



CH2M HILL HEALTH AND SAFETY PLAN

Attachment 8

Tick Fact Sheet

Tick-Borne Pathogens — A Fact Sheet

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are actually six notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity—even in places that are predominantly paved with bordering vegetation.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs and symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture.

On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. For this region, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Illnesses and Signs and Symptoms

There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite—normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs and symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted



rashes. The bite site may be red, swollen, or develop ulceration or lesions. For Lyme disease, the bite area will sometimes resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.



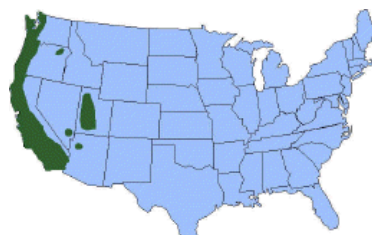
Deer Tick



From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)



Distribution of Deer Tick (dark green)



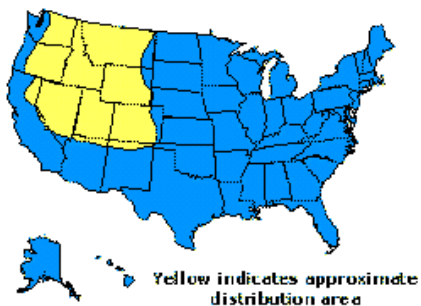
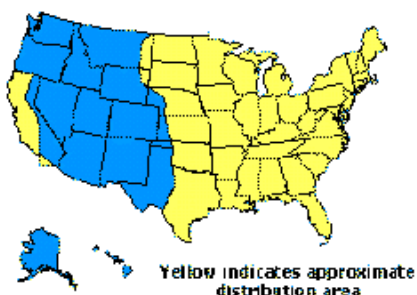
Distribution of Pacific Deer Tick (dark green)



Dog Tick



Rocky Mountain Wood Tick



Hazard Control

The methods for controlling exposure to ticks include, in order of most- to least-preferred:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acaricide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants—tick-borne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced by between 72 and 100 percent when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant or to a licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary to control exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be easily seen, wear light-colored clothing. Full-body New Tyvek® (paper-like disposable coveralls) may also be used
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots
- Wear long-sleeved shirts, a hat, and high boots
- Apply DEET repellent to exposed skin or clothing per product label
- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label
- Frequently check for ticks and remove from clothing
- At the end of the day, search your entire body for ticks (particularly groin, armpits, neck, and head) and shower

- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves any time ticks are handled

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid situations such as hand-to-face contact, eating, drinking, and smoking when applying or using repellents.

Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix™ Lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician.

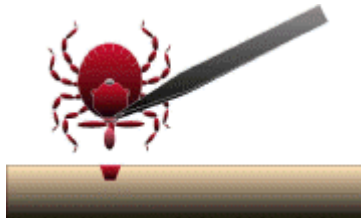
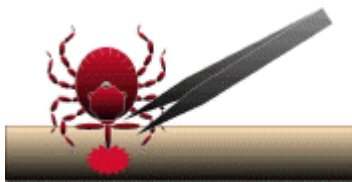
Tick Check

A tick check should be performed after field survey before entering the field vehicle (you do not want to infest your field vehicle with ticks). Have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thoroughly as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self check.

If a tick has embedded itself into the skin, remove the tick as described below.

Tick Removal

1. Use the tick removal kit obtained through the CH2M HILL Milwaukee warehouse, or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.
2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.



3. Avoid squeezing, crushing or puncturing the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. Should you wish to save the tick for identification, place it in a plastic bag, with the date of the tick bite, and place in your freezer. It may be used at a later date to assist a physician with making an accurate diagnosis (if you become ill).

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Individuals previously infected with Lyme disease does not confer immunity—reinfection from future tick bites can occur even after a person has contracted a tick-borne disease.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 9

Observed Hazard Form

OBSERVED HAZARD FORM

Name/Company of Observer (*optional*):

Date reported: _____

Time reported: _____

Contractor(s) performing unsafe act or creating unsafe condition:

1. _____

2. _____

3. _____

Unsafe Act or Condition:

Location of Unsafe Act or Condition:

Name of CH2M HILL Representative:

Corrective Actions Taken:

Date: _____

Project Safety Committee Evaluation:

Date: _____

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 10

Stop Work Order Form

Stop Work Order

REPORT PREPARED BY:

Name:	Title:	Signature:	Date:

ISSUE OF NONPERFORMANCE:

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	Title:	Signature:	Date:

** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,*

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	Title:	Signature:	Date:

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 11

Vehicle Accident Guidance

Vehicle Accident Guidance – ESBG

Remember that if you are renting a non-CH2M HILL owned vehicle (short-term rental) in the U.S., you should carry the insurance card from the state where your driver's license is issued.

If you operate a fleet vehicle, carry the insurance card where the vehicle is registered.

Please see link below to print out an insurance card (for **CH2M HILL employees** only). The page shows state-specific restrictions and the definitions of hired, owned, etc., vehicles.

https://communities.int.ch2m.com/legal/insurance/Shared%20Documents/AutoID_Cards.aspx?PageView=Shared

For ALL Vehicles if you are in an accident:

1. If you are injured, call 911 for emergency medical treatment or 1-866-893-2514 to contact the CH2M HILL Occupational Nurse/Physician for minor injuries. If you feel you have not been injured, contact the RHSM for guidance on whether calling the CH2M HILL Occupation Nurse/Physician is applicable.
2. **Call the Police** For any vehicle accident/damage, it is recommended that the local police (or site security/emergency services if working on a client site that provides such services) be called to determine if a report needs to be filed. In some instances, a report may not be required (during accident alerts, or in public parking lots). Document that the authorities were called and follow up with any guidance they give you. State requirements vary. If a report is filed, obtain a copy.
3. Notify supervisor, (and PM/RHSM if working on a project site)
4. Complete a HITS report on the VO.

Additional Steps for FLEET VEHICLES:

Definition: These are vehicles **rented for greater than 90 days** or rentals that are **leased** (either through ARI [Automotive Rental, Inc.] or leases from other companies [older fleet vehicles]).

Report the accident to the following:

1. **Fill out and Auto Loss Notice on the Virtual Office** (click "Company Resources," then "Corporate Groups," then "Insurance"). See screen shot below.

The screenshot shows a Microsoft Internet Explorer browser window displaying the CH2M HILL Virtual Office website. The address bar shows the URL: <https://www.int.ch2m.com/>. The website has a blue header with the text "CH2M HILL Virtual Office - Microsoft Internet Explorer". Below the header is a navigation bar with links: "My Virtual Office", "Alert", "Feedback", "Help", and "Customize My Page". The main content area is titled "Insurance" and contains a sidebar with links to "HOME", "BOND REQUEST FORMS", "BEST PRACTICES - RISK MANAGEMENT IN DIFFICULT ECONOMIC TIMES", "CERTIFICATE REQUEST FORMS", and "CLAIMS RESOURCE INFO". The main content area is titled "How Do I Report a Claim?" and contains a section for "Domestic" with a link to "Business Auto-All". Below this link is a table with the following information:

Initial Report:	Employee involved in auto accident reports claim as soon as possible directly to Insurance Department
Copy:	Jennifer Rindahl/DEN/Legal & Insurance Department
Form:	Automobile Loss Notice (completed by employee)
Insurer:	ZURICH AMERICAN INSURANCE
Phone:	Toll Free: 1 (877) 246-3478 or 1 (800) 987-3373
Fax:	Toll Free: 1 (877) 962-2567

Below the table are two links: "Business Auto-Owned by Leasing Company, Rental Agency, etc." and "Workers' Compensation". A blue arrow points from the text "Click on form, it will be submitted electronically." to the "Automobile Loss Notice" link in the table.

2. Contact Zurich (1-877-246-3478 or 1-800-987-3373).

3. Contact Linda George/DEN at 720-286-2057.

Note: If you are an ES employee that happens to use an **OMI vehicle** on a project and get into an accident, you must also contact Michelle Garlington/DEN (720-286-4273).

Additional Steps for RENTALS:

1. Fill out and Auto Loss Notice on the Virtual Office (click “Company Resources,” then “Corporate Groups,” then “Insurance”). See screen shot above.

2. Call 1-800-VISA-911 (only if the car has been **rented for less than 31 days** – they provide some additional physical damage coverage in this time period).

3. Call Zurich (1-877-246-3478 or 1-800-987-3373).

4. Call the rental company (Budget, National, Enterprise, etc.).

5. Call Jennifer Rindahl/DEN at 720-286-2449.

For Personally Owned Vehicles (POVs):

CH2M HILL does not provide auto insurance for POVs, it is responsibility of the owner. If you are in a vehicle accident conducting company business, contact the police as above, supervisor, and 911 or CH2M HILL’s occupational nurse/physician as stated above. Complete a HITS report. Refer to the Employee Handbook/Policies, assistance for meeting personal insurance deductibles (up to \$500) is available with proof of insurance and deductible.

If using your POV for extended project use, notify the PM to make sure a rental car is not needed. Check your insurance policy for guidance on using the POV for business use.

Additional Resources:

Business Auto Insurance Manual

[https://www.int.ch2m.com/webuploads/newsgenerator/travel/news/business_auto_manual\[1\].pdf](https://www.int.ch2m.com/webuploads/newsgenerator/travel/news/business_auto_manual[1].pdf)

Claims Resource Manual

https://communities.int.ch2m.com/legal/insurance/Shared Documents/Claims_Resource_Manual.doc

Attachment E

Example Lumex Mercury Analyzer SOP

STANDARD OPERATING PROCEDURES

Ohio Lumex Mercury Analyzer (Lumex RA 915)

AMBIENT AIR MONITORING PROGRAM for the 130 LIBERTY STREET DECONSTRUCTION PROJECT



LOWER MANHATTAN DEVELOPMENT CORPORATION
1 Liberty Plaza
New York, New York

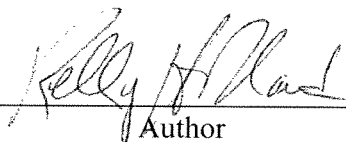
Prepared by:
TRC Corporation
Boott Mills South
116 John Street
Lowell, MA 01852
(978) 970-5600



Standard Operating Procedures

Ohio Lumex Mercury Analyzer (Lumex RA 915)

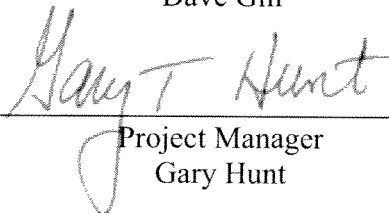
Revision 0
November 2005



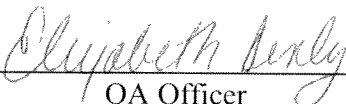
Author
Kelly Holland



Technical Reviewer
Dave Gill



Project Manager
Gary Hunt



QA Officer
Liz Denly

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1.0 PURPOSE OF SOP

This SOP was designed to describe the procedures used to sample mercury vapor in ambient air using the Ohio Lumex RA-915 monitor.

2.0 EQUIPMENT DESCRIPTION

The RA-915 Mercury Analyzer is a continuous ambient air monitor direct-read instrument based upon the principle of differential Zeeman atomic absorption spectrometry using high frequency modulation of light polarization. The operator will refer to the manufacturer's operation manual for pictorials and additional information to aid in performing operation and maintenance.

3.0 EQUIPMENT OPERATION

In order to operate the RA-915 Mercury Analyzer, it is necessary to attach a hose with a pre-filter at the intake location and attach a muffler at the exhaust port. (Note: Refer to manufacturer's operation manual for pictorials on where to attach intake hose and muffler.)

3.1 Instrument Start Up

1. Turn on instrument. The manufacturer's trademark will appear on the screen of the display and control unit.
2. Press the ENT key on the display and control unit. The MAIN MENU will be displayed and the "*" will appear in the upper left corner.
3. Press and hold for several seconds the LAMP IGNITION button on the front panel. When the spectral lamp turns on the "*" will go out. Allow lamp to warm up for 5 minutes before collecting data.

4.0 CALIBRATION

A serviceability test must be done prior to and after each sampling period to verify that the analyzer is functioning properly, as defined by the project specific QAPP.

1. Set the TEST handle to the off position.
2. Select the TEST command on the display unit and press the ENT button.
3. The SET OPTICAL BRIDGE TO POSITION III message will be displayed.
4. Set the optical bridge to position III and press the ENT button. A baseline test occurs for 20 seconds (turbo pump will turn on).
5. The Display will show "ENTER TEST CELL". Rotate Test Cell to "ON".
6. Press the ENT button. Air will be drawn through Zero Mercury Filter, as a countdown occurs for 10 seconds.
7. Allow to run several minutes, noting the relative deviation "R%" value.
8. If the "R%" value is less than 25%, the instrument is operating correctly.
9. Press the ESC button. The REMOVE THE TEST CELL message will appear.
10. Set the TEST handle of the test cell to the OFF position and press the ENT button. The MAIN MENU will be displayed.

5.0 SAMPLING

The ON STREAM command is used for measuring the mercury vapor concentration in the air.

1. Set the TEST handle to the OFF position.
2. Select the ON STREAM mode from the MAIN MENU and press the ENT button.
3. The SET OPTICAL BRIDGE TO POSITION III message will be displayed.
4. Set the optical bridge handle to position III and press the ENT button.
5. A baseline test occurs for 20 seconds and the intake valve assembly will switch from Zero Mercury Filter to Intake Hose. Readings will commence with an update every second.
 - a. "S" = Every second
 - b. "Si" = Every 10 seconds
6. Press the ENT button again. Readings will continue every second, but with various functions:
 - a. Three 10 second averages
 - b. After 30 seconds, a 30 second average will display (Say)
 - c. Relative Standard Deviation will display (R%)
7. Select DATA LOGGER and press ENT to begin logging 10 minute averages.

NOTE: The detection limit of the analyzer is 2 ng/m^3 for gaseous mercury. Readings below this value will be reported as " $< 2 \text{ ng/m}^3$."

6.0 MAINTENANCE

Maintenance of the analyzer includes:

- Daily visual inspection
- Battery charging
- Changing the dust filters (inlet port, pre-filter)
- Changing the zero mercury absorption filter
- Preventative maintenance

During the daily visual inspection make sure that there is no physical damage of the analyzer housing and of its parts. Ensure that all the cables are undamaged and securely fastened.

During preventative maintenance, check the housing covers and if necessary, change the dust and absorption filters. It is recommended to carry out annual pre-verification maintenance of the analyzer at the manufacturer's center.

7.0 ADDITIONAL INFORMATION

A more detailed equipment manual available from Ohio Lumex is located in the site office for any other questions about the Mercury Analyzer.



Mercury Quick Reference Guidance Sheet

Introduction

The concentration values discussed here are *not regulatory requirements but rather health-based recommendations* meant to prevent hazards to health following a mercury spill. Large mercury spills, those that equal or exceed one pound, should be reported to the National Response Center (800-424-8802). MDCH believes that even small spills, like from a fever thermometer, can pose a hazard to human health depending upon the sensitivity of the individuals exposed (especially children under the age of 6), the length of exposure, the room size, temperature, frequency of air changes, and other variables.

This guidance can be used during a cleanup and for clearance levels afterwards. The clearance concentration numbers may be adjusted higher or lower, depending upon the specific situation. For example, the clearance or re-occupancy level for an elementary classroom would be different than that for a senior center. Those conducting screening or cleanup can call the MDCH Toxics and Health Hotline (1-800-MI-TOXIC or 1-800-648-6942) to consult with staff regarding particular situations.

Instrumentation and Units

MDCH and the U.S. EPA typically use a Lumex® mercury-vapor analyzer machine when investigating mercury spills. These machines measure the air concentration of mercury in real time. The Lumex RA915+ analyzer reports mercury concentrations in nanograms per cubic meter (ng/m³). The Lumex “Lite” reports concentrations in micrograms per cubic meter (µg/m³). It is important to understand the units your machine is reporting:

$$1,000 \text{ ng/m}^3 = 1 \text{ µg/m}^3$$

Testing Items

Check floors and other possibly affected surfaces and compare readings to breathing zone concentrations. If surface readings are higher, a source of mercury is likely present. Residual mercury beads may be invisible to the naked eye.

Seal suspect items in plastic bags, allow to warm up (>70°F) in a warm room or the sunshine, and test the headspace to determine if they are contaminated.

It is a good idea to always screen the vacuum cleaner, washing machine, and clothes dryer. Consider checking sink traps too.

Occupancy During Clean-up:

Indoor Concentration		Suggested Action*	Discussion
ng/m ³	µg/m ³		
<1,000	<1	Occupants can remain in building	The level below which occupants may choose to stay in a dwelling for the duration of a clean-up of reasonable length of time (i.e., days vs. weeks)
Between 1,000 and 10,000	Between 1 and 10	Occupants may need to leave	Values in this range may require a site-specific plan to minimize exposure for sensitive populations. Keep windows open for adequate fresh air exchanges.
>10,000	>10	Occupants should leave	
>20,000	>20	Evacuate occupants. Open windows to ventilate. Do not characterize further.	This situation should be handled by professionals.
>50,000	>50	Evacuate occupants. Do not enter.	The Lumex tends to be less accurate in the higher range. Actual concentrations may be much higher and more acutely hazardous. This situation should be handled by professionals.

*When deciding upon actions, consider whether the mercury is confined to an area that can be sealed off from the rest of the building.

Screening Objects:

Indoor Concentration		Suggested Action	Discussion
ng/m ³	µg/m ³		
<1,000	<1	Items may be acceptable to keep.	No hotspots at carpet surface. Porous materials (throw rugs, upholstered furniture, linens, clothing) may be aired out in the sun – DO NOT LAUNDER. Hard surfaces can be cleaned, then aired out in the sun. Consider re-screening items before returning to use.
Between 1,000 and 10,000	Between 1 and 10	Items may not be acceptable to keep.	Remove and dispose of affected carpeting and padding. Err on the side of caution and dispose of other affected materials. (Antiques and heirlooms may be exceptions.) Or, air out items for weeks in a warm, non-living space and consider re-screening before returning to use.
>10,000	>10	Items should not be kept.	

Post Clean-up Acceptable Air Clearance Values:

Indoor Concentration**		Suggested Action	Discussion
ng/m ³	µg/m ³		
<1,000	<1	Clean-up is sufficient for re-occupancy of residential structure.	Value assumes pregnant women and/or children under the age of 6 years live in the affected dwelling.
<3,000	<3	Clean-up may be sufficient for re-occupancy of non-residential structure. Use professional judgment for areas having sensitive populations (e.g., schools, daycares, clinics). NIOSH 6009 testing may be recommended.	Clearance number is not applicable to occupational settings where mercury is normally handled.

**All source mercury and contaminated items have been removed and adequate ventilation has occurred. Measurement is taken from breathing zone.



Environmental Health Information

Mercury Flooring Testing and Mitigation: Guidance for Environmental Professionals

August 2008

This guidance is for environmental testing and mitigation of exposure to mercury vapor from mercury-containing polymer floors (typically a soft poured-in-place floor in a gymnasium from 1990s or earlier). It should not be used to develop plans for handling mercury vapor from a spill.

Determine if a floor contains mercury

The Minnesota Department of Health (MDH) recommends that a sample of a floor suspected to contain mercury be analyzed by a laboratory to determine the mercury content. If the floor contains less than 1 part per million (ppm) mercury, it can be assumed that the flooring was not manufactured using a mercury-containing catalyst.

If the floor contains less than 20 ppm mercury, it is unlikely that exposures to mercury vapor in the gym could reach levels of concern. Care should be taken to limit possible exposures when these floors are removed or modified in the future. In addition, there may be state and federal disposal requirements for the flooring material due to the mercury content (see “Long-term Planning”, below).

If the floor contains 20 ppm mercury or more, the mercury vapor concentration in the gym may approach or exceed levels of health concern under some conditions. Therefore, MDH recommends testing the mercury vapor concentration in these gyms under a variety of conditions as described below.

MDH mercury vapor exposure guidelines

MDH recommends that the general public should not be exposed to short-term (acute or one hour) mercury air concentrations above 1800 ng/m^3 . This conservative criterion protects all people, including sensitive individuals, such as pregnant women and children.

For longer term exposures, MDH recommends that gym teachers should not be exposed to more than 750 ng/m^3 mercury vapor during 40 hour work weeks averaged over the school year. Children exercising in the gym will have a greater respiration rate than teachers. Therefore, their exposure should be limited to 750 ng/m^3 during 16 hours or less per week averaged over the school year.

MDH long-term mercury vapor exposure guidelines are based on the EPA Integrated Risk Information System Reference Concentration of 300 ng/m^3 for chronic exposures. These recommendations assume that students and teachers are not exposed to additional significant, long-term sources of mercury vapor other than the gym.

More information on mercury exposure guidelines can be found in the MDH Memo on Mercury Cleanup Concentrations at

<http://www.health.state.mn.us/divs/eh/hazardous/topics/mercury/vaporeconc0107.pdf>.



Minnesota Department of Health ♦ Division of Environmental Health ♦ Site Assessment and Consultation Unit

651.201.4897, or 1.800.657.3908, press 0 ♦ www.health.state.mn.us

Mercury vapor testing

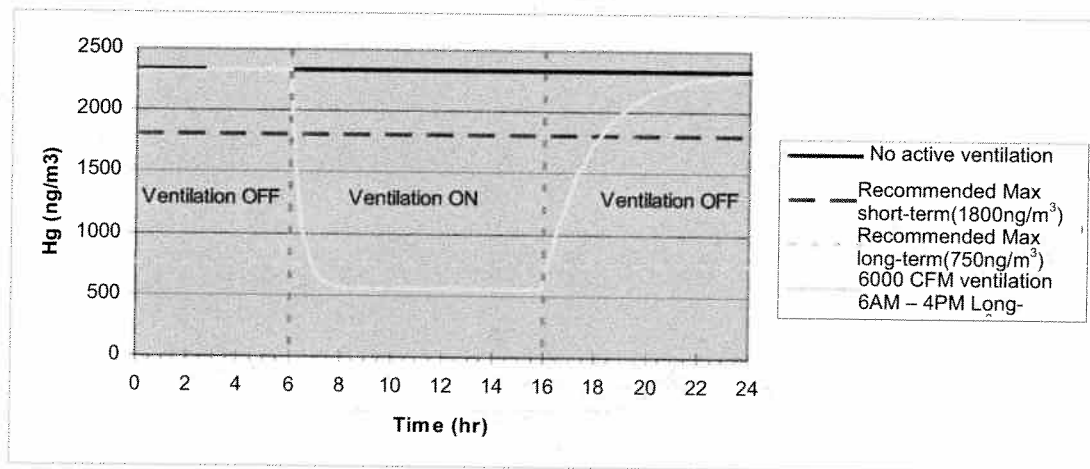
Real-time mercury vapor analyzers (e.g. some models of Lumex, Jerome) do an excellent job of detecting mercury vapor concentrations at any single point in time. The minimum detection limit for an instrument used to measure mercury vapor concentrations in a school or in an area where the public may be exposed should be 300 nanograms per cubic meter (ng/m^3) or less. It is important to remember that the data describes the concentration at one point in time. At any other time, if conditions (e.g. temperature, ventilation) have changed, the mercury vapor concentration will be different.

Other methods of mercury vapor testing can be used (e.g. NIOSH 6009), but they require chemical analysis of samples that are taken over extended periods of time. Averaging mercury vapor concentrations over time, as these methods do, may result in more realistic exposure data. In addition, they may remove some sampling recording bias. However, unless sample collection is guided by real-time sampling with a real-time mercury vapor analyzer, the maximum exposure concentrations are not likely to be measured. Further, these methods can be more complex and expensive than real-time measurements.

Mercury vapor concentration is related to ventilation

Mercury evaporates very slowly from materials that contain mercury. Increasing the ventilation of the gym is an effective way to decrease mercury vapor concentrations. When the ventilation is turned off, mercury vapor concentrations will slowly increase. Figure 1 is a graph that shows how mercury vapor concentrations in a gym over a 24 hour period can change when there are changes in ventilation. After the ventilation is turned on, the mercury vapor concentration decreases relatively rapidly over a 1-2 hour period. When the ventilation is turned off, the mercury vapor concentration slowly increases. Because ventilation affects mercury vapor concentrations, it is important to stabilize air movement in a gym for some time prior to measuring mercury vapor concentrations.

Figure 1: Impact of ventilation on mercury vapor concentration in a gymnasium



(This figure is a demonstration of possible air concentrations in a gym over 24 hours. It is compiled from a model suggested by available data and is not actual data from a gym.)

Mercury vapor concentration is related to temperature

Mercury evaporates much faster when it is hot than when it is cold. An MDH study (unpublished) suggests that the rate mercury is emitted from mercury-containing floors doubles for approximately

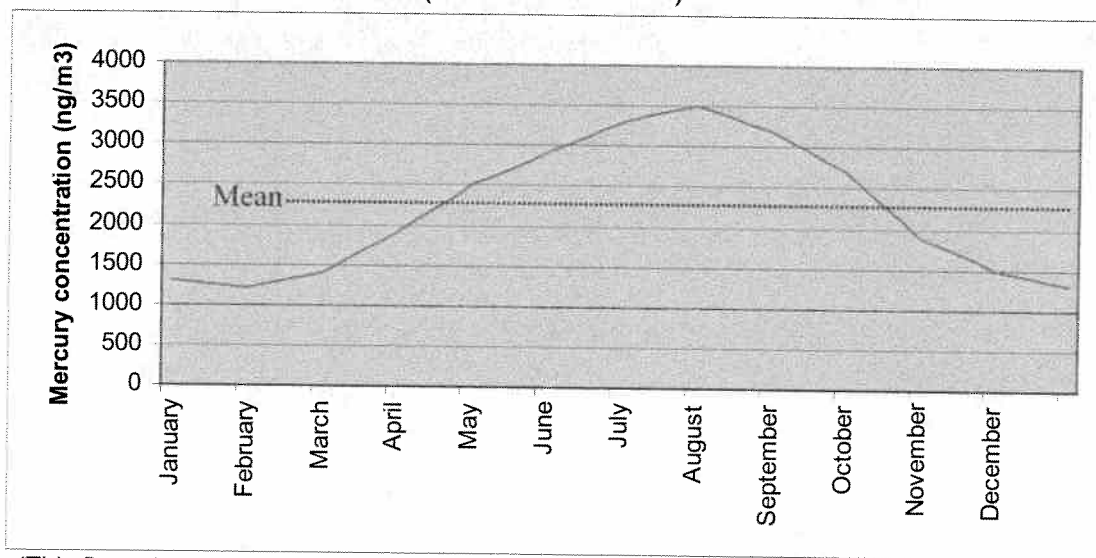
every 9° F increase in floor temperature. Therefore, measuring mercury vapor concentration in a room during different seasons is important for estimating long-term exposures to mercury.

MDH has developed a ventilation calculator (model) that can be used to estimate the mercury vapor concentration in a gym at a given floor temperature and ventilation rate. Or, the calculator can estimate the amount of ventilation required to achieve a target mercury vapor concentration at a given floor temperature. The required inputs for the calculator are: gym dimensions; floor temperatures and mercury vapor concentrations under 2 different ventilation settings. The calculator is available at <http://www.health.state.mn.us/divs/eh/hazardous/topics/mercury/hgvaporcalc.html>. Mercury vapor concentrations in the gym should be tested after ventilation changes to verify reductions.

Seasonal changes in emission rate and ventilation

The temperature of a gym floor and the ventilation of a gym will vary according to the seasons. This seasonal variation in temperature and ventilation will result in seasonal changes of mercury vapor concentrations. Figure 2 shows an example of mercury vapor concentrations that may be found in a gym with a mercury-containing floor over 12 months.

Figure 2: Seasonal change in mercury vapor concentration in a gymnasium (normal ventilation)

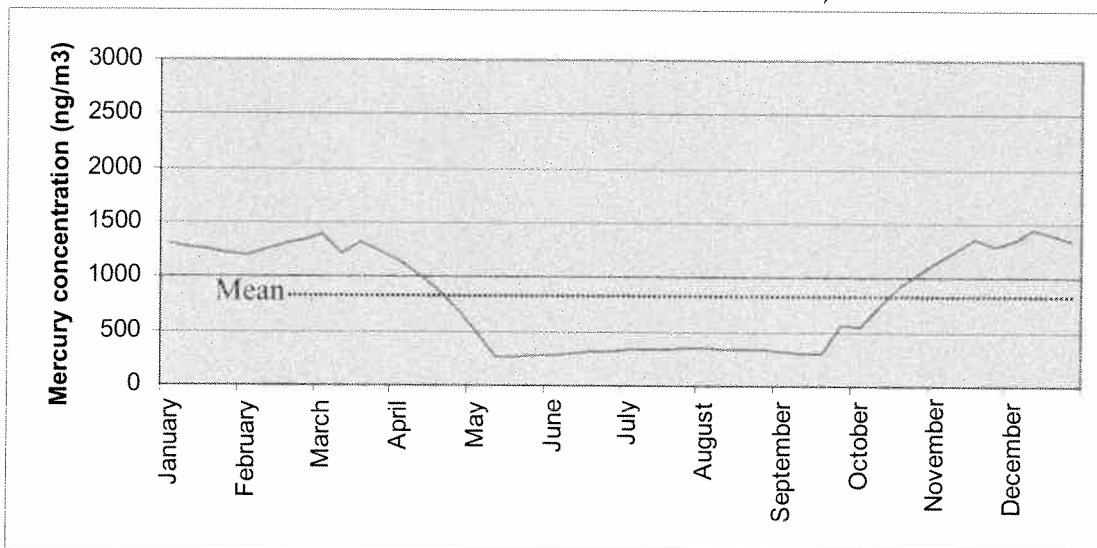


(This figure is a demonstration of possible air concentrations in a gym with normal ventilation. It is compiled from a model suggested by available data and is not actual data from a gym.)

If a gym is tested during the winter when floor temperature is low, mercury vapor concentrations may be low. However, in the spring, summer and fall the floor temperature can be much higher. In addition, active (mechanical) ventilation may also be limited during these seasons. Due to these factors, the highest mercury vapor concentrations are typically found in the late spring, summer and early fall. The MDH ventilation calculator can help environmental professionals to predict mercury vapor concentrations under different conditions; or to suggest ventilation rates for maintaining acceptable mercury vapor concentrations at different floor temperatures. The calculator is a tool that generates an estimate from the best available model. However, it is not likely to be accurate for all gyms under all conditions. Mercury vapor concentrations used to determine possible exposures to people should only be inferred from actual sample measurements and not from model results.

Figure 3 shows an example of the effect of increasing ventilation in the gym on the mercury vapor concentrations in the spring, summer and fall. In the examples shown, the average exposures from August 15 through June 15 for teachers and students would be 2275 ng/m³ under normal ventilation (Figure 2) and 825 ng/m³ under the increased ventilation schedule (Figure 3).

Figure 3: Seasonal change in mercury vapor concentration in a gymnasium
(March to November, warm weather ventilation)



(This figure is a demonstration of possible air concentrations in a gym with additional, active warm weather ventilation. It is compiled from a model suggested by available data and is not actual data from a gym.)

The 10 month school day average in the non-ventilated example shown in Figure 2, of 2275 ng/m³, is a long-term average exposure that exceeds MDH exposure guidelines for both short-term and long-term exposures to mercury vapor. Additional ventilation or mitigation is necessary to protect public health in this example.

The 10 month school day average, of 825 ng/m³, in the increased ventilation example shown in Figure 3, is an average calculated from very uncertain data. It is likely that if mercury vapor concentrations were measured a day before or a day later, the data would be different. Yet the data suggest that the 10 month average is within 10% of the MDH long-term criterion of 750 ng/m³. Given the many possible sources of variability, MDH considers the exposures from this spring through fall ventilation example to be consistent with the MDH guidelines for long-term exposure. For this example, additional ventilation above the increase already in place is not necessary. However MDH does recommend that additional sampling be conducted over the next year to confirm that the mercury vapor concentrations have decreased. If increased ventilation was necessary to achieve a school year average below MDH guidelines, long-term mitigation and ventilation controls need to be in place to assure that mercury vapor concentrations remain below these levels even as staffing changes occur.

What should be done to evaluate and mitigate exposures?

Mercury vapor exposure calculations discussed throughout this information sheet are limited to exposures in school gyms from mercury-containing floors. They do not include additional exposures to mercury vapor, including exposures to mercury vapor from gym flooring that may occur in rooms adjacent to a gym or to mercury vapor from unrelated mercury spills. If school year

average exposures above 750 ng/m³ may occur for more than 40 or 16 hours per week for teachers or students, respectively, contact the MDH Indoor Air Program at: 651-201-4601.

It is important to remember that exposures to mercury have been occurring since the floor was installed. A few days of additional exposure will not greatly increase risk. Actions to limit future exposures can be carefully planned. It is unlikely there would be a need for immediate intervention. However, student or teacher exposures above 1800 ng/m³ should be avoided.

If sampling shows:

- Mercury vapor concentration over 1800 ng/m³:
 1. Confirm that the mercury vapor analyzer is operating properly.
 2. Do not allow use of the gym until mercury vapor concentrations are shown to be below 1800 ng/m³.
 3. Increase ventilation.
 4. Verify (by retesting) that increasing ventilation has reduced mercury vapor concentrations to less than 1800 ng/m³. Once levels are below 1800 ng/m³, the gym can be used in the short-term, so long as further testing verifies year-round average concentrations at or below 750 ng/m³.
 5. Discuss long-term ventilation and mitigation options with building engineers, consulting with the MPCA and MDH as necessary.
 6. Make appropriate adjustments to the yearly ventilation schedule to assure that the school year average concentration is 750 ng/m³ or below.
 7. Retest during other seasons, especially during the summer, to verify exposure concentrations and to ensure exposure criteria are met.
 8. Implement an operations and maintenance plan for the ventilation equipment to ensure ventilation rates remain consistent in future years.
 9. If ventilation adjustments do not sufficiently reduce the school year average to less than 750 ng/m³, additional actions including removal of the flooring should be considered. Continue to supply adequate ventilation to maintain mercury vapor concentrations below 1800 ng/m³ and to minimize mercury exposures until the flooring is removed.
- Mercury vapor concentration between 750 ng/m³ and 1800 ng/m³:
 1. Confirm that the mercury vapor analyzer is operating properly.
 2. Retest under similar (normal) conditions within a few days.
 3. If the concentration is still 750 – 1800 ng/m³, increase ventilation to achieve 750 ng/m³ or below:
 - If this is not possible due to heating costs or ventilation constraints, determine whether it may be possible to increase ventilation during certain months to keep the school year average concentration at 750 ng/m³ or below.
 4. Make appropriate adjustments to the yearly ventilation schedule to assure that the school year average concentration is 750 ng/m³ or below.
 5. Retest at least once per season to assure that the school year average concentration is 750 ng/m³ or below.
 6. If ventilation adjustments do not sufficiently reduce the school year average, additional actions including removal of the flooring should be explored. Continue to supply adequate ventilation to maintain mercury vapor concentrations below 1800 ng/m³ and to minimize mercury exposures until exposures can be sufficiently reduced (for example by: adding ventilation or by removing the flooring).

- Mercury vapor concentration 750 ng/m³ or below:
 1. Confirm that the mercury vapor analyzer is operating properly.
 2. Retest seasonally to assure that the school year average concentration is 750 ng/m³ or below:
 - Make necessary adjustments to the yearly ventilation schedule if there are exceedances.
 3. If ventilation does not maintain this school year average, additional actions including removal of the flooring should be explored.
 4. Plans should be developed to assure that an adequate ventilation schedule is maintained until the floor is removed.

Long-term planning

Ventilation should be maintained at levels that assure average year-round mercury vapor concentrations are less than 750 ng/m³. If changes are made to the heating, air conditioning or ventilation in the school, or if there are changes to the gym that may affect mercury emissions or ventilation, mercury vapor concentrations in the gym should be measured again. If removal of the mercury-containing floor will not occur for a number of years (regardless of mercury vapor concentrations in the gym), it is important that records are maintained and that the institutional memory of the issues related to mercury-containing floors is preserved.

Prior to removing mercury-containing flooring, the school should contact the MPCA for information on disposal. A contractor with experience in removing hazardous floorings should be engaged for removal of the flooring. Appropriate measures, including mercury vapor monitoring and maintenance of negative pressure in the gym, should be taken to assure that staff and students are not exposed during removal and replacement of the gym floor.

If you have questions about health, exposure or risk, contact Carl Herbrandson, Ph.D.:
 (651) 201-4906
carl.herbrandson@state.mn.us

If you have questions about mitigation or indoor air in schools, contact Daniel Tranter:
 (651) 201-4618
daniel.tranter@state.mn.us

For information about disposal of mercury-containing floors, contact Don Nelson at the MPCA:
 (651) 296-8621 or toll free, (800) 657-3864
don.nelson@pca.state.mn.us

For information about the MPCA Mercury-Free Zone program for schools, contact Carol Hubbard:
 (651) 282-2604 or toll free, (800) 657-3864
carol.hubbard@pca.state.mn.us

For more information contact: MDH/Site Assessment and Consultation: (651) 201-4897 or 1 (800) 657-3908, press 3 and leave a message. To request this document in another format, call (651) 201-5000 or TDD (651) 201-5797.

This information sheet was prepared with partial support from the federal Agency for Toxic Substances and Disease Registry (ATSDR). This statement does not imply that ATSDR has endorsed this information sheet.

Attachment F
Laboratory Provided Analytical SOPs

QA/QC Manual and Standard Operating Procedures

Metals Analysis by Atomic Absorption Spectrophotometry

Reviewed and Approved By:

Eric Snyder, President IATL

Robert G. Shumate, Health & Safety Officer

Frank E. Ehrenfeld III, Laboratory Director

John Napolitan, QA Coordinator

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Revision Date

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 - 5.1.1 Method: ASTM D3335-85a
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 - 5.2.2. Method: TSP 40CFR , App G
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- 5.6. Sample Matrix: Consumer Products – Non-Porous
 - 5.6.1 Method:EPA SW846 3050/7420
 - 5.6.2. QC PreparationReplicate / Spike / Blanks
 - 5.6.3. Sample Disclaimers Matrix Modifications
- 5.7. Sample Matrix: Consumer Products – Porous
 - 5.7.1 Method:EPA SW846 3050/7420
 - 5.7.2. QC PreparationReplicate / Spike / Blanks
 - 5.7.3. Sample Disclaimers Matrix Modifications
- 5.8. Sample Matrix: TCLP
 - 5.8.1 Method:EPA SW846 1311
 - 5.8.2. QC PreparationReplicate / Spike / Blanks
 - 5.8.3. Sample Disclaimers Matrix Modifications
- 5.9. Glassware Clean-up
- 5.10. Method Addendums / Procedure to Alter or Proprietary Methods
- 5.11. New Method Implementation

Sample Analysis.....	6	1/3/05
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6.1. Instrument Set-up: Flame

- 6.1.1 Warm-up and Gases
- 6.1.2 Computer Program Parameters
- 6.1.3 Nebulizer Set-up
- 6.1.4 Standards
- 6.1.5 Calibration
- 6.1.6 Metals Lamps / Alignment

6.2. Instrument Set-up: Furnace

- 6.2.1 Warm-up and Gases
- 6.2.2 Computer Program Parameters
- 6.2.3 Auto-Sampler Set-up
- 6.2.4 Graphite Platform Set-up
- 6.2.5 Calibration
- 6.2.6 Metals Lamps / Alignment

6.3. Worksheet and Data Entry

6.4. Instrument Trouble Shooting / Log

<u>Quality Control</u>	7	3/2/09
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7.1. QC Sample Type

- 7.1.1 Blanks
- 7.1.2 Spikes
- 7.1.3 Replicates
- 7.1.4 Standards
- 7.1.5 Blind QC

7.2. Quality Practices

7.2.1. Accuracy - Investigations are performed to determine how close a measurement comes to an actual or accepted reference value. Accuracy can be expressed as percent recovery and evaluated by analysis of matrix spike samples. A matrix spike is an aliquot of a sample fortified with a known quantity of the analyte of interest and subjected to the entire analytical procedure. For dust/wipe samples, blank collection material is utilized.

7.2.2. Precision - Precision is evaluated by the reproducibility of analyses. Precision is commonly expressed as standard deviation or relative percent difference (RPD) and can be evaluated by the analysis of duplicate samples. Duplicate sample analyses are one or more additional analyses on separate portions of a given sample in order to assist in the evaluation of method variance. For dust/wipe samples, blank collection material spiked in duplicate.

7.2.3. Uncertainty – Uncertainty is used to determine the range of dispersion that could reasonably be attributed to sample results. In accordance with ISO 17025 section 5.4.6 IATL has produced an Uncertainty Budget comprised of the sources of uncertainty in the lab. The final value is calculated by the root-sum-of-squares (RSS) method and is expressed as the expanded uncertainty (U_c), or the Best Measurement Capability (BMC). This is the value used as part of a statement on the client COA to accompany analytical measurements.

7.2.4. Method Blanks - IATL runs at least one method blank per every 20 samples. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination. These blanks may also be termed digestion blanks or reagent blanks.

7.2.4. Field Blanks – Client field blanks are analyzed along side all other samples. Blank correction is not performed on samples related to a given field blank. Clients are informed by annotation on their preliminary results in the event that field blanks are not submitted with wipe or air samples.

7.2.5. Laboratory Control Samples – (LCS) An SRM fortified sample is analyzed with each matrix batch at the 5% level for sample batches larger than 20. Again, if fewer than 20 samples are prepared, at

least one sample must be of this type. The concentration of the sample must be within the working range of calibration. It is not required that the source be NIST traceable, but these samples must at least be old PAT rounds or other samples with published and verifiable results.

7.2.6. Matrix Blanks - IATL runs at least one matrix blank for every 20 samples (air/wipe). A matrix blank is a wipe material or air filter documented to contain no lead. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination. If fewer than 20 samples are run, than at least one of these samples is employed.

7.2.7. Reporting Level Verification Spikes - For each matrix analyzed a matrix blank is to be spiked at the level of the lowest calibration standard. These samples are to be prepared parallel to client samples at a frequency of once per day. Liquid spiking is acceptable.

7.2.8. Post Spikes – (PS) Directly following the analysis of a water sample a post spike is analyzed to insure that results are not suppressed by matrix interference. One sample having a concentration of 16 ppb or less must be spiked and yield a recovery of 90% to 110% per client project. Recoveries outside of limits require sample dilution and reanalysis and post spike. Repeat this process until recoveries are within limits.

7.3. Calculations

- 7.3.1. Air
- 7.3.2. Paint
- 7.3.3. Dust/Wipe
- 7.3.4. Soil
- 7.3.5. Water
- 7.3.6. Percent Recovery
- 7.3.7. Relative Percent Difference
- 7.3.8. Misc. Calculations

7.4. Preliminary Results

7.5. Data Validation

7.6. QC Records / Analysis

Title:

Section:

Revision Date

Quality Control(Continued)

7.7. Nonconforming Test Work

7.8. Corrective Actions, CAR process, and Preventative Actions

7.9. Proficiencies

- 7.9.1. AIHA-PAT
- 7.9.2. ELLPAT
- 7.9.3. NYSDOH: ELAP
- 7.9.4. NJ-DEP
- 7.9.5. EPA SW
- 7.9.6. NIST Standards

7.10. Inter-Laboratory QC Program

7.11. Customer Complaints

7.12. System Audits

7.13. Document Control Policy

Archiving8 6/30/06

Samples of Laboratory Data & Reports9 11/06/02

- 9.1. Daily QC Data sheet
- 9.2. Raw Data sheets
- 9.3. Preliminary Results
- 9.4. Certificates of Analysis / Final Report
- 9.5. Data / Report Review
- 9.6. Sample Management Documents
- 9.7. Disclaimer List
- 9.8. Records Retention
- 9.9. Test Report Corrections

<u>Laboratory Health & Safety Program: Summary</u>	10	11/06/02
10.1. Chemical Hygiene Plan (29CFR1910)		
10.2. Supply Inventory		
10.3. Lab Hygiene, Housekeeping		
10.4. Personal Protection		
10.5. Spill Procedures		
10.6. MSDS		
<u>Laboratory HazMat / Waste Disposal</u>	11	9/26/02
<u>Glossary (AIHA Re-Print)</u>	12	11/25/95

i Scope of Analytical Services:

It is the intent of International Asbestos Testing Laboratories to ensure its total commitment to a complete quality assurance/quality control program. This includes strict adherence to accuracy, precision, completeness, and representativeness of values for all analytical results. These results are obtained through strict adherence to sample chain-of-custody and holding requirements, routine use of calibration standards and quality control samples, and use of EPA approved analytical procedures, aided by a computerized lab data management system. Corporate and business objectives are reflected in our quality of staff, facilities, level of customer service, code of ethics and competitive pricing. Simply stated, IATL exists as a commercial laboratory that strives to meet or exceed recognized levels of quality analysis as required by NIST-NVLAP, AIHA, EPA, ISO and other regulatory and accrediting bodies.

International Asbestos Testing Laboratories (IATL) was incorporated in 1986 to offer a full range of asbestos and lead laboratory services for the environmental industry. Since then, IATL has emerged as a respected leader in the asbestos and lead testing field. IATL maintains its corporate headquarters in Mount Laurel, New Jersey.

IATL offers a range of asbestos analysis services including Phase Contrast Microscopy (PCM), Polarized Light Microscopy (PLM), and Transmission Electron Microscopy (TEM) with X-Ray Microanalysis (EDXA). The laboratory also has lead (water, air, paint, soil, and dust) analytical capabilities by Atomic Absorption Spectroscopy (AAS). From our instrumentation and new facilities to our excellent technical staff, IATL maintains the highest standards in quality. Our commitment to quality has been recognized by several accrediting bodies including the American Industrial Hygiene Association (AIHA), the National Voluntary Laboratory Accreditation Program (NVLAP), and the New York Environmental Laboratory Accreditation Program (ELAP). IATL is one of the first participants in AIHA's

Environmental Lead Proficiency Analytical Program (ELPAT). In addition, all of our microscopists are registered in AIHA's Asbestos Analysts Registry (AIHA-AAR). Our technical staff has over sixty years experience in environmental laboratory testing.

With sharp competition and the increasing wealth of regulatory restrictions, the laboratory services industry has undergone its expected maturity. With this maturity, IATL anticipates that more mature consulting firms, will choose us to deliver *quality*. Indeed, the experience gained by our clients indicates their willingness to work as partners with our laboratory to further ensure quality analyses. We hope that our client base, Engineering firms, Contractors, Public Health Administrators, School Facilities Professionals, etc., recognize our commitment to leadership in the industry.

We *invite* you to tour our facilities, offer your comments regarding this SOP and QC Manual, and further inquire into other services. We *challenge* you to find another more independent and qualified laboratory.

Frank E. Ehrenfeld III
Laboratory Director

i- Laboratory Capabilities:

Unlike many other Environmental Laboratories, IATL *specializes* in only two analytes: asbestos and lead. Everything from our facilities to staff was selected with these clearly focused analytical objectives in mind. Because of general industry demand, IATL has established several operating procedures to assure customer satisfaction. IATL brings a level of *customer service* highly regarded by hundreds of public and private firms throughout the country. As such IATL prides itself on meeting turnaround times that often require a round-the-clock commitment from our technical and support staff. Our dedication to customer service through quality analysis and technical follow-up has increased our popularity over the years. Our business philosophy is to pursue excellence in a well-managed realm where our expertise is recognized, and our *value* is appreciated.

How is IATL able to provide quality results on over 100,000 asbestos/lead samples per year?

- Highly skilled technical and support staff!
- State-of-the-art instrumentation all under manufacturer's service contract!
- Providing asbestos/lead analysis only!
- LIMS network for expedited sample management and report generation!
- Customer Service Representatives that work with YOU!

i- Laboratory Accreditations:

- | | |
|--|--|
| • American Industrial Hygiene Association (AIHA)
Industrial Hygiene Laboratory Accreditation
Asbestos Analyst Registry Program | Lab ID # 100188
Certificate # 444
4029, 4879 |
| • National Voluntary Laboratory Accreditation Program (NVLAP)**
through NIST, for Bulk Asbestos Analysis by PLM | NVLAP #
101165-0 |
| • National Voluntary Laboratory Accreditation Program (NVLAP)**
through NIST, for Airborne Asbestos Analysis by TEM | NVLAP #
101165-0 |
| • American Industrial Hygiene Association (AIHA)
National Lead Laboratory Accreditation Program (NLLAP)
Environmental Lead Laboratory Accreditation Program (ELLAP)
Proficiency Analytical Testing Program, Metals and Asbestos | Lab ID # 100188

PAT # 100188 |
| • Environmental Lead Proficiency Analytical Testing Program
Proficiency Dust/Wipe, Soil, and Paint Chip PAT, through AIHA | ELPAT # 100188 |
| • New York State Department of Health, Environmental Laboratory
Approval Program, PCM, PLM, TEM, NOB, and AAS-lead | ELAP #
11021 |
| • The Commonwealth of Massachusetts, Department of Labor
and Industry, Asbestos Testing Program | A A # 0000092 |
| • Rhode Island Department of Health, Division of Occupational
Health, Certification to Provide Asbestos Analytical Services | 184 |
| • The Commonwealth of Virginia, Department of Professional and
Occupational Regulation - Asbestos Analytical Laboratory License | 3333 000045 |
| • The State of Connecticut, Department of Public Health
Environmental Health Services Division
Asbestos Air and Bulk Certification | PH- 0760 |
| • The State of New Jersey, Department of Environmental Protection | 03863 |
| • State of Maine, Department of Environmental Protection
Asbestos Analytical Laboratory (Air: PCM, TEM) (Bulk: PLM) | LB-005, LA-004 |
| • The State of West Virginia, Bureau Of Public Health
Asbestos Air and Bulk Sample Analytical Laboratory | LT000168 |
| • The State of Texas, Department of Health
Asbestos Laboratory (TEM, PLM and PCM) | 30-0151 |
| • The State of Ohio, Department of Health
Environmental Lead Analytical Laboratory | 10017 |
| • American Society of Testing Materials | 0581 |
| • The State of Louisiana
Department of Environmental Quality | 02043 |
| • The City of Philadelphia, Analytical Testing Laboratory Certification | Lab ID# 101 |

i- Disclaimers

This is a working document written for International Asbestos Testing Laboratories (IATL). QA/QC Programs and Standard Operating Procedures for Atomic Absorption Spectrophotometry analyses are outlined herein.

The information outlined within this document is intended for use by IATL staff and their representatives only. Any reproductions may be obtained only by expressed written consent of the Laboratory Director.

This comprehensive SOP and QC Manual addresses the basic elements of IATL's quality assurance program and was written in accordance with EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80)".

This document is never complete, but is under constant audit by internal review and external requirements from accrediting bodies. Other sources of information that may be mentioned within the body of this text, but not listed completely due to space limitations include:

- Laboratory Training Program records
- Chemical Hygiene Plan (29CFR1910)
- EPA-Right to Know Information
- HazMat EPA Manifests for Waste Disposal
- Previous Safety Reviews
- Insurance Audits
- Professional Liability Insurance Documentation
- Federal, State, and Local business certificates, tax ID etc.
- Material Safety Data Sheets
- Instrument Manuals

If you wish to comment or recommend changes to this document, or if you desire a copy of certain sections of this document, please provide the same in writing to:

Laboratory Director
International Asbestos Testing Laboratories
9000 Commerce Parkway, Suite B
Mt. Laurel, NJ 08054
(856) 231-9449

ii- How to Use This Manual

If you are reading this document it must mean that you are either a technical staff member of IATL, QA/QC Management or the Laboratory Director at IATL, or an evaluator of IATL's operations. This document is a combination Standard Operating Procedures and QA/QC Manual for Atomic Absorption Spectrophotometry analyses of metals in the various matrices listed.

Within these pages, you will find information regarding IATL's:

- history and laboratory services,
- staff members, their qualifications and training,
- instrumentation and facilities,
- sample management procedures,
- analysis procedures,
- quality assurance practices,
- analytical data review and reporting,
- laboratory safety, and
- our approach to quality through all of the above.

The manual is organized in sections. The Table of Contents summarizes these sections and the dates of recent revisions. There are Glossaries and Abbreviation listings (from AIHA publication) in the rear of the document for easy reference. Though the language is often filled with jargon and typical third-party coldness, IATL wishes to present a document that will be easy to read for staff training purposes. In our attempt we also strive to never misrepresent our objectives and practices.

There is always a fine line between a document that will act as a tool, having practical applications, and one that attempts to wear down the curious reader with mounds of verbiage. Though we have attempted to be complete, direct, and understandable, we also realize that in some cases only references to documents can be made (e.g. 29CFR 1910, Chemical Hygiene Plan). Hence our technical library contains more detail, references, and documentation than this tool!

Because you must be one of the interested parties listed above, you must also know that this document is never finished or complete. Instead we discuss the procedures for review of the manual as well as means to amend its contents while documenting revisions.

ii.1 Model for SOPs and QA Manual:

IATL has several SOP and QA/QC Manuals in use for various analyses for asbestos and lead in several matrices. We base these documents upon established protocol published by environmental laboratory accrediting bodies. Our SOPs have been reviewed both by Laboratory Director and a Certified Industrial Hygienist for completeness.

The following models were used as a guideline for this document:

- NJDEP, Office of Quality Assurance, Regulations Governing Laboratory Certification and Standards of Performance, NJAC 7:18 July 1984
- EPA, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80)
- EPA/HUD, Lead Based Paint Guideline for Identification and Abatement, March 6, 1990.
- ASTM D-3335-85a, Test method for Low Concentration of Lead in Paint by Atomic Absorption Spectrometry, 1985.
- EPA, Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air, 40CFR Part 50, Appendix G.
- NIOSH 7082, Lead in Air Collected on Cellulose Ester Filters by AAS-Flame, 1990
- NIOSH 7105, Lead in Air Collected on Cellulose Ester Filters by AAS-Furnace, 1990
- EPA SW-846:7420, Lead in Paint Soil by AAS-Flame, 1990
- EPA SW 846:7421, Lead in Paint by AAS-Furnace, 1990
- Environmental Compliance Reporter:
- ISO 25 Guidelines for Accrediting Laboratories, 1990

ii.2 Review and Audit Procedures

There are *four ways in which the SOP QC Manual is reviewed and audited as a prerequisite to amendments and revision*. The first method concerns regular meetings between laboratory staff and management. The complete IATL technical staff meets at least four times per year. These meetings cover a wide range of topics (i.e. Safety and Hygiene, practical communications and QC announcements etc). They also serve as focal points for final presentations by individual staff and/or management to propose changes in SOPs etc. Reports are read with recommendations for change and amendments. These are taken under consideration by the Laboratory Director and the QA Coordinator to determine worthiness of the proposed changes. Other meetings (e.g. AAS Staff three times annually) are utilized to further refine proposed lab policy and procedures.

Secondly, the IATL Laboratory Director uses a checklist similar to that supplied by the AIHA and NYSDOH:ELAP organizations for Assessor Training Programs. The items on this list are reviewed and summarized annually by the Laboratory Director and QA Coordinator and presented to the IATL President.

The third review method concerns on-site evaluations from outside entities, their checklist reports, and IATL's response to their assessments. IATL is visited by NVLAP, NJDEP, NYSDOH:ELAP, and AIHA on an annual and/or biannual basis.

Finally, technical updates to methods, instrumentation, the quality system, data reduction etc., may periodically change and will need to be incorporated into this document.

ii.3 Amendment, Revision and Approval

The review process may conclude that certain items, sections, practices, etc., be revised and amended. These are incorporated in the SOP QA Manual only after approval of Laboratory Director with review by Health & Safety Officer, QA/QC Coordinator and Certified Industrial Hygienist. If analytical procedures or methods change, then subsequent studies using standards and blanks must be run to review the effectiveness of proposed changes on analytical validity. The data from such studies will be filed and cited with the Manual changes as "see AAS.95.TESTRUN.01/01/95" or similar notation.

Revisions will be incorporated into the SOP and QA Manual by the following mechanism:

1. Submittal of proposed changes to the Laboratory Director in writing,
2. Experimental validation (if necessary) and data review by QA Coordinator,
3. Review of Health & Safety Officer of such impact,
4. Notation of changes by TESTRUN file and Chemical Hygiene Plan file,
5. Approval by all signatories and revision of new dated Title Page to Manual,
6. Revision and newly dated Table of Contents to Manual
7. Revision of whole section affected in Manual with new dates.
8. Footnote: Revision ID, Software file ID, date change. (see below)

Header Unchanged	
Software ID	
Revision ID	
New Date	Page #

ii.4 Management Quality Policy and Objectives

IATL's management is committed to good professional practice, to the quality of its testing, and the level of service provided to its customers.

The goal of any company is to build a growing thriving business. IATL has been able to achieve this by giving clients quality results in a timely manner. So, it is the objective of the QC program to ensure that a quality system is present and verifiable. Initiating and maintaining quality in the lab is easy! It only requires discipline and dedication by technical staff to do 'it' and the same commitment by the management team to see that 'it' is done.

IATL adheres to all stated QA/QC requirements as published to ensure compliance with all of its accrediting bodies. (ISO, AIHA, NVLAP, ELAP, & NJDEP) Company management demonstrates this commitment to quality in all areas including facilities, hiring qualified staff, training programs, and constant review during preparation, analyses, and reporting of samples. QA procedures are constantly being reviewed and updated (see Sections ii.2 & 5.7).

It is the intent of International Asbestos Testing Laboratories to ensure its total commitment to a complete quality assurance quality control program. This includes strict adherence to accuracy, precision, completeness, and representativeness of values for all analytical results. These results are obtained through strict adherence to sample chain of custody and holding requirements, routine use of calibration standards and quality control samples, and use of EPA approved analytical procedures, aided by a computerized lab data management system. Corporate and business objectives are reflected in our quality of staff, facilities, level of customer service, code of ethics and competitive pricing. Simply stated, IATL exists as a commercial laboratory that strives to meet or exceed recognized levels of quality analysis as required by NIST-NVLAP, AIHA, EPA, ISO and other regulatory and accrediting bodies.

1.0 Laboratory Personnel

1.1 Key Personnel / Organizational Chart

The key element in a laboratory, even beyond its instrumentation, is its technical and support staff. The quality of analysis is often dependent upon the competence of personnel.

IATL's laboratory staff consists of 20 trained and certified professionals. Because the industry depends heavily on laboratory results on a daily basis, the laboratory is "on call" 24 hours a day. Through the summer months, IATL's facility becomes a round-the-clock laboratory. Communications between outside contractors/engineers are coordinated through the Laboratory Director and Customer Services Representatives. IATL has cellular phones for laboratory staff, an answering machine listing these emergency numbers, and a sample drop box located at our facilities for after hours sample delivery.

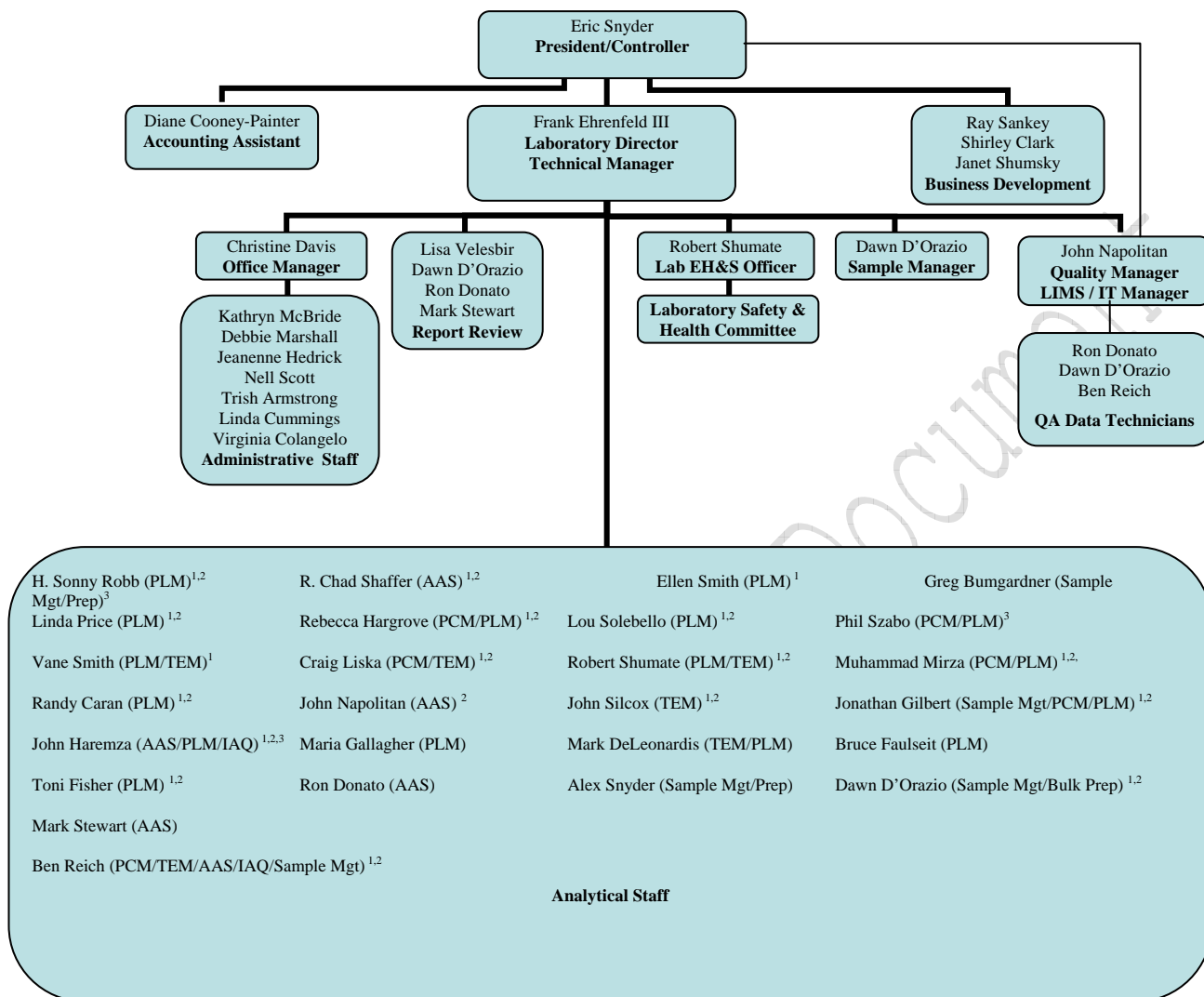
IATL's senior staff has access to specialists in regulatory affairs, industrial hygiene, chemical, environmental and materials engineering, geology, and contaminated materials testing. This comprehensive professional resource base allows us to provide, by referral, a full range of environmental laboratory services for asbestos and environmental assessment projects.

Understanding the necessity for all of our employees to be highly trained, IATL has incorporated a complete in-house training program for its technical specialists. Through our training programs, we are able to institute a consistent approach for both technical and ethical policies within our organization, and provide up-to-date information to ensure our procedures remain state-of-the-art.

An organizational chart is included for your quick reference.

Our full Statement of Qualifications package and Laboratory Training Program Staff Files have within them the detailed backgrounds of IATL staff. Please note...

- All PCM analysts are NIOSH 582 or equivalent.
- All PLM analysts are McCrone trained or equivalent.
- All TEM analysts are either McCrone trained or have attended professional courses in TEM techniques.
- All AAS/Metals analysts have extensive in-house training.
- All analysts are degreed in the physical sciences or have previous laboratory experience.



1 Senior Analyst

2 Lab Training Program Qualified Instructor

3 Lab Misc. Prep Technician

PCM = Phase Contrast Microscopy

AAS = Atomic Absorption Spectrophotometry

PLM = Polarized Light Microscopy

TEM = Transmission Electron Microscopy

IAQ = Indoor Air Quality (Mold)

1.2 Key Personnel Summary Background:

□ **Frank E. Ehrenfeld III, Laboratory Director:** Mr. Ehrenfeld has an extensive educational background and strong application experience in academic, industrial, and commercial analytical microscopy laboratory environments, specializing in the characterization of materials using diffraction and microanalysis techniques. Frank has been active in the asbestos and lead analytical field for over seven years. Frank participates in NVLAP conference seminars (ASTM Johnson Conference) and other regulatory affairs reviews. Other tours of duty include Princeton Testing Laboratories and Graduate Research at Lehigh University. Mr. Ehrenfeld was the Laboratory Manager at AWI/The Earth Technology Corporation Laboratory previous to his employ at IATL. He also serves as QA Coordinator for the AAS Metals Lab at IATL. **Education:** B.S. Chemistry/Biology at West Chester University, 1984. M.S. Candidate in Materials Science and Engineering at Lehigh University 1996. Graduate work in Industrial Hygiene at Temple University School of Civil Engineering 1988 - 1991.

Certifications / Affiliations:

- Advanced Light-Optical Microscopy, McCrone Research Institute, 1989
- Advanced Analytical Electron Microscopy, Lehigh University, 1989
- Electron Microscope Society of America, Biological Techniques 1983
- Management Skills Workshop, American Management Association, 1989
- X-Ray Microanalysis, Princeton Gamma-Tech and Kevex/FISONS, 1988
- NIOSH 582 Equivalency, Occupational Medical Corporation, 1988
- AIHA Asbestos Analyst Registry No. 4882 (Board Certified), 1992
- Who's Who Environmental Registry 1991/1992
- Finalist: MIT's Symposium on Analytical Electron Microscopy, 1991
- Electron Microscope Society of America, since 1987
- American Society of Testing Materials, since 1989
- Microbeam Analysis Society, since 1987
- American Chemical Society, since 1983
- American Management Association, since 1989
- American Industrial Hygiene Association (applicant)
- American Chemical Society, QA/QC Statistics in the Laboratory, 1996
- ASTM Committee D-22, Atmospheres (Asbestos Sampling and Analysis), 1997
- Environmental Information Association, since 1997

☐ **Sonny H. Robb, Asbestos Laboratory QC Coordinator:** Mr. Robb has been involved with asbestos laboratory related projects since 1988. Though qualified in all areas of the laboratory, his involvement with asbestos is primarily concentrated on bulk examinations using PLM. Mr. Robb has been recognized by many leading authorities for his expertise in this area. Sonny is responsible for QC activities, PAT reporting, and in-house training. Previous to his employ at IATL, Sonny held similar positions at The Earth Technology Corporation and Criterion Labs. **Education:** B.S. Geology, West Chester University. M.S. Physical Sciences, West Chester University.

Certifications / Affiliations:

- Occupational Safety & Health for Hazardous Waste Operations, PADEP, 1991
- Geological-Mineralogy Studies, Lehigh University, 1988-89
- X-Ray Microanalysis, Kevex/FISONS, 1990
- NIOSH 582 Equivalency, Criterion Labs, 1992
- AIHA Asbestos Analyst Registry No. 4883 (Board Certified), 1992
- Polarized Light Microscopy for Bulk Asbestos Identification, AWI, 1987
- Tarr Award , Meritorious Achievement in Earth Sciences, WCU 1988
- Philadelphia Chapter Electron Microscope Society of America, since 1990
- American Industrial Hygiene Association (applicant)
- Mineralogical Association of Canada, since 1989

☐ **Craig A. Liska, Senior Laboratory Technician:** Mr. Liska has been involved with environmental related laboratory projects since 1987. Craig had a long stint at Alternative Ways / The Earth Technology Laboratory where he was their principal TEM analyst. Craig has researched TEM Dust/MicroVac techniques that have been incorporated into many engineering studies. He has also experimented with NOB techniques through NYSDOH ELAP Program. He assisted in the development of the Chemical Hygiene plan that has been adopted by the laboratory. Craig is also qualified as an AAS Metals technician level II. **Education:** B.S. Biology Boston College 1981.

- AIHA Asbestos Analyst Registry No. 4881 (Board Certified)
- Occupational Medical Corporation : NIOSH 582 Equivalency, 1987
- X-Ray Microanalysis, Kevex Corporation, 1990
- Microscopical Identification of Asbestos PLM: McCrone Research Institute , 1993
- McCrone Research Institute: Course 411 (TEM/SAED Advanced Techniques), 1994
- IATL In-House Training for Environmental Lead Sample Preparation, 1994
- Analytical Electron Microscopy, JEOL, 1989

☐ **Vane G. Smith III, Senior Laboratory Technician:** Mr. Smith brings a unique perspective to IATL. Vane spent a few years as an Asbestos Safety Technician in the field performing both air monitoring and bulk surveys. As such, he is especially sensitive to the requirements posed upon our clients. He is instrumental in HazMat, Chemical Hygiene Plan implementation and Right-To-Know certification as well as DOT Hazardous Material Regulation qualifications. Mr. Smith is especially strong in PLM examinations. Vane is IATL's Health and Safety Officer. **Education:** B.S. Occupational Health and Safety, Millersville University 1985.

- AHERA Building Inspector, Delaware EPA Region, 1987
- American Industrial Hygiene Association, Member 1991
- NIOSH 582 Equivalency, Occupational Medical Center, 1986
- AIHA Asbestos Analyst Registry No. 4719
- Microscopical Identification of Asbestos, McCrone Institute, 1991
- Asbestos in Air by TEM, IATL Level II Analyst, 1998

☐ **Ben A. Reich, Senior Laboratory Technician:** Mr. Reich has been involved with the asbestos and lead testing industry since 1990. Ben began his asbestos analytical career at Alternative Ways where he was one of their principal PCM

analysts. In that time he has participated in several large AHERA clearance projects. He served as a chemistry technician for DNA Plan technologies while in college. Mr. Reich is closely involved with PCM QA/QC. Education: B.S. Physics, Rutgers University 1994.

- AIHA Asbestos Analyst Registry No. 4879
- OMC : NIOSH 582 Equivalency, 1990
- Atomic Absorption Spectrophotometry: Environmental Studies, 1993
- Analytical Electron Microscopy, AWI/IATL Training Course
- Asbestos Bulk NOB and Potable Water Sample Preparation, IATL TEM 1994

☐ Rebecca R. Hargrove, Laboratory Technician: Mrs. Hargrove has been involved with asbestos laboratory related projects since 1986. Her involvement with asbestos is primarily concentrated on bulk examinations using PLM. Mrs. Hargrove held similar positions at The Earth Technology Corporation, MedLab Environmental Testing, and Accredited Environmental Technologies. Education: B.S. Environmental Resource Management, Penn State University 1983

- NIOSH 582 Equivalency, Occupational Medical Corporation 1987
- Bulk Asbestos Sample Preparation and Analysis, IATL PLM 1995
- Quantitative Asbestos Analysis by PLM: McCrone Research Institute 1997
- Airborne Asbestos Preparation and Analysis, IATL 1997
- AIHA Asbestos Analyst Registry No. 7163

☐ John Haremza, Senior Laboratory Technician: John is responsible for PLM and TEM analysis, Log-In, and various sample preparation activities at IATL. Mr. Haremza has environmental laboratory experience from PDI Environmental and Rowan University. Education: B.S. Biology, Rowan University, 1994

- Microscopical Identification of Asbestos PLM: McCrone Research Institute 1995
- Asbestos Bulk NOB8 and Potable Water Sample Preparation, IATL TEM 1995
- Asbestos Analysis by Analytical TEM, IATL TEM 1998
- Atomic Absorption Spectroscopy, Environmental Studies, 1996

☐ **Jonathan S. Gilbert, Laboratory Technician:** Mr. Gilbert is a part-time employee at IATL. He is responsible for Sample login, PCM prep, and analysis. Jon fully participates in our in-house PCM QC program and maintains his AIHA-AAR certification through our efforts. Mr. Gilbert works full-time as an Environmental Scientist for RK Occupational and Environmental Services. He has been Project Manager for RK and Probe Environmental. Jon is approved as an Asbestos Safety Technician and has over ten years experience in design and implementation of asbestos control and remediation projects. Education: Rutgers university B.S. Biology

- AIHA Asbestos Analyst Registry No. 5337
- NIOSH 582 Equivalency, Temple University EPA Region III 1987
- New Jersey Asbestos Safety Technician, EOHSI, 1998

☐ **James Weitzman Jr., Laboratory Technician:** Mr. Weitzman has been involved with asbestos laboratory related projects since 1981. When not analyzing bulk samples, Jim's activities at IATL revolve around QA/QC data input and interpretation. He is an approved Data Validation technician for all asbestos analyses. As such he reviews a significant number of final reports and Certificates of Analysis. His involvement with asbestos analysis is concentrated on bulk examinations using PLM and airborne analysis by PCM. Jim is an approved Laboratory Manager, meeting both NYSDOH and AIHA criteria for that position. Mr. Weitzman was involved in NIOSH 582 instruction as a consultant for many years. In September 2000, Jim's dream of becoming a high school biology teacher came true. He remains on our staff on a part time basis. Mr. Weitzman was the Laboratory Manager at Particle Diagnostics, a Kaselaan and D'Angelo Company / Hill International Company. Education: Rowan University B. S. Biology 1998

- NIOSH 582 Equivalency, Temple University EPA Region III 1981
- Microscopical Identification of Asb. PLM: McCrone Research Institute 1983
- AIHA Asbestos Analyst Registry No. 1535

☐ **John A. Napolitan, QA/QC Coordinator:** Mr. Napolitan has been involved with environmental related laboratory projects since 1989. John had a long history with AnalytiKEM where he was an inorganic chemist. John is involved with quality assurance for all disciplines of analysis at IATL. Additionally John handles some of the duties of LIMS management and other supply and purchasing projects. Several technical developments for lead in paint analysis have evolved since his careful study of this specialized test. As of July 2000, John has become a certified Information Technology Specialist. He is A+ Certified and a Microsoft Certified Professional. John continues to provide in-house training in the AAS arena. Education: A.S. Chemistry, Burlington County College, 1990.

- Environmental Lead Laboratory Procedures: IATL 1997
- Atomic Absorption Spectrophotometry, Environmental Studies 1997
- Network Administration & Engineering, CHUBB Institute 2000
- Cisco Administration, BCC/Cisco 2003
- Matrix LIMS, Matrix Administration Course 2004

☐ **R. Chad Shaffer, Laboratory Technician:** Mr. Shaffer is responsible for Environmental Lead preparation and analysis as well as zinc, cadmium, and chromium metals analysis. He is proficient in using the AAAnalyst 400 for Flame and Perkin-Elmer 2100 for Graphite Furnace operations. His organization skills and his attention to detail have allowed for a great deal of growth in this department. Chad also provides some AAS training and coordinates additional analysts in this area. Education: B.S. Environmental Science, Delaware Valley College, 1997

- In-House Laboratory Training Program; Sample Management IATL 1998
- Airborne Asbestos Sample Preparation, IATL TEM 1998
- Asbestos Bulk NOB and Potable Water Sample Preparation, IATL TEM 1998
- Atomic Absorption Spectroscopy, Environmental Lead Studies, 2000

❑ Muhammad T. Mirza, Senior Laboratory Technician: Mr. Mirza has been involved with asbestos related laboratory projects since 1990. Muhammad's previous employment was with the Planning Design and Research Engineering where he had wide ranging industrial hygiene responsibilities and where he was a principal PLM analyst. Mr. Mirza is involved with PCM, PLM, QA/QC and Health and Safety issues. Education: B.S. Chemical Engineering, Punjab Lahore University, 1989

- AIHA Asbestos Analyst Registry No. 5741
- NIOSH 582 Equivalency: PDR Inc., 1994
- Microscopical Identification of Asbestos PLM: McCrone Research Institute 1995

❑ John C. Silcox, Laboratory Technician: Mr. Silcox had over 30 years experience in managing electron microscopy laboratories. He is a nationally recognized authority on cryoultramicrotomy. He has taught EM at Duke University and Shanghai Medical University in China. John has experience on TEM, EDXA, EELS, and other EM techniques. John has been a Research Scientist and Laboratory Manager at the University of Virginia, University of Pennsylvania, Temple University, and has run his own consulting service specializing in cryoultramicrotomy since 1985. Mr. Silcox has several publications in the Journal of Microscopy, Microbeam Analysis Journal, and EMSA Proceedings Manuals. Education: B. S. Biology, Temple University; B.S. Electronics, LaSalle University.

- Electron Microscope Society of America
- Microbeam Analysis Society

❑ Ellen Smith, Laboratory Technician: Mrs. Smith has been involved with asbestos related laboratory projects since 1990. Ellen worked at BCM Laboratories where she was a Chemist and eventually learned the basics of asbestos bulk and airborne analysis. She later refined these skills at Accredited Environmental Technologies, Media, PA in 1997. Ellen also has experience in various acid digestion techniques and has utilized AAS instrumentation. Education: B.S. Biology, Lincoln University, 1986

- AIHA Asbestos Analyst Registry No. 2025
- Temple University Center for Environmental Studies: NIOSH 582, 1988
- Microscopical Identification of Asbestos, Environmental Training Corporation, 1989
- American Chemical Society
- American Industrial Hygiene Association
- Microscopy Society of America
- National Asbestos Council
- Philadelphia Geological Society

☐ Lou Solebello, Laboratory Technician: Mr. Solebello has been involved with asbestos laboratory related projects since 1986. Though qualified in all areas of the laboratory, his involvement with asbestos is primarily concentrated on bulk examinations using PLM. Mr. Solebello has been recognized by many leading authorities for his expertise in this area. He has authored over twenty professional publications including the Primary Forensic Geology chapter of Saferstein's Forensic Science Handbook. Previous to his employ at IATL, Lou held similar positions at McCrone Associates, Scientific Laboratories, J.M. Huber, Kaselaan and D'Angelo, Thornton Labs, HydroDesigns, and Analytical Light Microscopy Services. Education: B.S. Geology, 1984 University of Florida. M.S. Geology 1987, University of South Florida.

- American Chemical Society
- Geological Society of America
- Clay Mineralogy Association
- NIOSH 582 Equivalency
- Polarized Light Microscopy for Bulk Asbestos Identification, McCrone
- Microscopy Society of America

☐ Robert Shumate, Laboratory Technician: Mr. Shumate has been involved with environmental analysis since 1986. His experiences include AAS, PCM, TEM, and PLM as well as GC and FT/IR. Bob also has Managerial, QA/QC, and training experience in a NVLAP accredited laboratory. Asbestos has been his primary focus since 1991. Currently Bob's duties are exclusively in the area of PLM analysis.

Education: B.S. Environmental Science at, University of Delaware, ADG 2009

- Mineralogical Society of America, 2006
- EPA 600, Analysis of Bulk Asbestos, US Navy, 1988
- NIOSH 582, US Navy, 1988
- OSHA Asbestos Abatement Workers Training Course, Tidewater Comm. College, 1989
- Advanced Asbestos Identification, McCrone Research Institute, 1992

☐ Linda Price, Laboratory Technician: Ms. Price has been involved with asbestos analysis since 1989. Her experiences include PCM, TEM, and PLM. Linda also has supervisory, QA/QC, and PLM training experience. Currently Linda's duties are exclusively in the area of PLM analysis.

Education: Camden & Gloucester County Colleges, 1975 – 1978

- Polarized Light Microscopy for Bulk Asbestos Identification, McCrone, 1990
- NIOSH 582 Equivalency, EMSL, 1989
- EMSL In-House Training for Analytical Electron Microscopy, 1989

1.2. Key Personnel Summary Background (continued):

☐ Christine Davis

Mrs. Davis has been in the Environmental industry since 1982 with Duall Maintenance Company Inc. She has been at IATL since 1992. Previous to this position she worked at Edward J. Post Company as a Special Needs Accountant for 2 years. Mrs. Davis is the Office Manager. As such, she sees that initial Preliminary Results are Faxed to clients in a timely manner. Chris assists in LIMS Log-In, data entry for Certificate of Analysis generation, archiving reports, mail-out of reports, and initial customer service for all inquiries. She has authority to provide initial data review of reports.

☐ Eric Snyder

Mr. Snyder has been in the Environmental industry since 1989 with the Environmental Control Group as Accountant/Controller. He has been at IATL since 1992 and is the company president as of September of 2007. Eric wears many hats at IATL. Mr. Snyder is responsible for all Accounts Receivable and Accounts Payable. Eric is our Human Resources, Collections, and Payroll Department in one. He is responsible for invoicing procedures and questions regarding this aspect of report generation may be addressed to him.

☐ Ray Sankey / Shirley Clark

Both Ray and Shirley have been in the environmental industry for several years. Shirley has been at IATL since 1989. Though Marketing Development / Sales Representatives both are involved in customer service and can assist the client from project set-up to report clarification.

☐ H. Sonny Robb / Ben Reich

The backgrounds of both of these technical staff members are included in a previous section. These staff members are occasionally used for data validation. All calculations and QC results are thoroughly checked before analysis data is submitted for release to clients. Records are strictly maintained as EPA/AIHA dictates.

1.3 Code of Ethics

IATL employs a Code of Ethics (see next page) that must be read, signed, and reviewed once per year by employee and employer during the Performance Appraisal period in December or January of each year. This Code of Ethics is also involved in the company interview process prior to employment, and is reviewed and signed as read and accepted by employee and employer when an offer of employment has been accepted. These are on file with the Laboratory Director and copied in the Laboratory Training Program Summary File. IATL employs this tool to ensure a more formal compliance with established analytical procedures, the production of a higher quality of data, and to bind technicians to a written set of "non-tangible" objectives. In this way clients are served with impartiality and integrity. IATL also uses this to further assure the employee that their workplace environment and general safety and health are of importance and will be recognized and supported by the company.

1.3.1 Mission Statement

It is the intent of International Asbestos Testing Laboratories to ensure its total commitment to a complete quality assurance/quality control program. This includes strict adherence to accuracy, precision, completeness, and representativeness of values for all analytical results. Corporate and business objectives are reflected in our quality of staff, facilities, level of customer service, code of ethics and competitive pricing. Simply stated, IATL exists as a commercial laboratory that strives to meet or exceed recognized levels of quality analysis as required by NIST-NVLAP, AIHA, EPA, ISO and other regulatory and accrediting bodies.

We *invite* you to tour our facilities, offer your comments regarding this SOP and QC Manual, and further inquire into other services. We *challenge* you to find another more independent and qualified laboratory.

1.4 Required Background of Laboratory Staff:

In accordance with EPA Guidelines and IATL adopted policy, the key laboratory staff positions shall be filled by qualified individuals. It is understood that IATL must notify accrediting bodies (e.g. AIHA, NYSDOH, NIST, NJDEP etc.) when changes to key positions (Laboratory director, QA Supervisor etc.) take place. Education, experience, training, and competence are taken into consideration prior to employment and other prerequisites as outlined below are required for each position:

1.4.1 Laboratory Director

Education	Technical Experience	Management Experience	On-Site Participation
B.S. Chemistry or B.S. Physical Sci.	3 years Inorganic and Instrumental Chemistry (AAS)	3 years and/or 3 years QA Mgt	40 hours / week

IATL requires that its Laboratory Director be on-site full time. Because of its technical nature, the Laboratory Director is required to have at least a bachelors degree in Chemistry or a related Physical Science. Practical technical experience is required by this position so that in-house training, QA operations, and customer service can be competently addressed by the Laboratory Director. As such, the Laboratory Director shall be able to function at all levels within the laboratory operations. This includes sample login, sample prep, sample analysis, and data reduction steps. The position requires complete knowledge of Methods used, OSHA Safety provisions to be considered, and other technical items involved in the operation of an analytical laboratory. A minimum of three years laboratory management experience or three years of QA Supervision, including formal college or outside training in statistics, is required for the position.

1.4.2 QA Supervisor

Education	Technical Experience	Management Experience	On-Site Participation
B.S. Chemistry or Physical Sci.	3 years Inorganic and Instrumental Chemistry (AAS)	NA	40 hours / week
Associates Degree in Chemsitry or Phys. Science	5 years Inorganic and Instrumental Chemistry (AAS)	NA	40 hours / week

IATL requires that its QA Supervisor be on-site full time. Because of its technical nature, the QA Supervisor is required to have at least a bachelor's degree in Chemistry or a related Physical Science or an Associates degree with at least 5 years related experience. Practical technical experience is required by this position so that in-house training and QA operations can be competently addressed by the QA Supervisor. As such, the QA Supervisor shall be able to function at all levels within the laboratory operations. The position requires complete knowledge of Methods used, OSHA Safety provisions to be considered, and other technical items involved in the operations of an analytical laboratory. A formal course in statistics is required as part of the position. The statistical course should include aspects of windsorization of data, bias checks, precision accuracy computations, etc. At IATL, the Laboratory Director may assume the duties of the QA Supervisor. Currently, IATL employs an asbestos laboratory QA Coordinator separate from the Laboratory Director. The Laboratory Director does assume this role for the Metals department.

1.4.3 AAS Analyst Level I

Education	Technical Experience	LTP Completion	Metals Participation
B.S. Chemistry or B.S. Physical Sci.	2 years Inorganic and Instrumental Chemistry (AAS), at least 1 year non academic.	1- Demonstrates All Prep Methods 2- Completes All Method Literature 3- Demonstrates both Flame & Furnace 4- All Safety & HazMat program 5- Data Reduction	20 hours / month 10 blind QC samples per quarter

IATL requires that its AAS Level I Analysts to be on-site full time. The technician does not have to participate in environmental metals analysis 40 hours a week, but must at least maintain a 20 hour per month minimum. Because of its technical nature, the Level I Analyst is required to have at least a bachelor's degree in Chemistry or a related Physical Science. Practical technical experience is required by this position. This must include at least two years inorganic and/or instrumental chemistry of which one year may be recorded at an academic setting. The position requires knowledge of Methods used, OSHA Safety provisions to be considered, and other technical items involved in the operations of instrumentation. The Laboratory Training Program (see Sec. 1.6) Summary displays certain preparation routines, method literature reviewed and utilized, and the demonstration of technique and training such that preparation and analysis of samples may be completed with little supervision. The Level I analyst retains that rating by performing metals analysis at least 20 hours per month, being proficient on at least 10 blind QC sample submitted per quarter, and reviewing all method releases, literature publications, and statistically satisfies the QA Supervisor.

1.4.4 AAS Analyst Level II

Education	Technical Experience	LTP Completion	Metals Participation
B.S. Chemistry or B.S. Physical Sci.	1 year Inorganic and Instrumental Chemistry (AAS), at least 1 year non academic.	1- Demonstrates Level II Prep Methods 2- Demonstrates both Flame AAS 3- All Safety & HazMat program 4- Data Reduction	20 hours / month 10 blind QC samples per quarter for AAS flame

IATL does not require that its AAS Level II Analysts be on-site full time. The technician does not have to participate in environmental metals analysis 40 hours a week, but must at least maintain a 20 hour per month minimum. Because of its technical nature, the Level II Analyst is required to have at least an associate's degree in Chemistry or a related Physical Science. Practical technical experience is required by this position. This must include at least one year inorganic and/or instrumental chemistry which may be recorded at an academic setting. The position requires knowledge of Methods used, OSHA Safety provisions to be considered, and other technical items involved in the operations of instrumentation. The Laboratory Training Program (see Sec. 1.6) Summary displays certain preparation routines, method literature reviewed and utilized, and the demonstration of technique and training such that preparation and analysis of samples may be completed with modest supervision. The Level II analyst retains that rating by performing metals analysis at least 20 hours per month, being proficient on at least 10 blind QC sample submitted for AAS Flame analysis per quarter, and statistically satisfying the QA Supervisor.

1.4.5 AAS Analyst Level III

Education	Technical Experience	LTP Completion	Metals Participation
Enrolled in a B.S. program at accredited college or B.S. Physical Sci.	In-house training program for minimum sample preparation techniques.	1- Demonstrates Environmental Paint/Wipe/Soil/ & air Prep Methods 2- All Safety & HazMat program	8 hours / month Daily review by Level I Analyst

IATL does not require that its AAS Level III Analysts be on-site full time. The technician does not have to participate in environmental metals analysis 40 hours a week, but must at least maintain a 8 hour per month minimum. Because of its technical nature, the Level III Analyst is required to be at least enrolled in a bachelor's degree program in Chemistry or a related Physical Science. Practical technical experience is required by this position. The IATL in-house Laboratory Training Program (LTP) will be able to provide necessary training to all Level III technicians. The LTP must include OSHA Safety and HazMat information and other technical items involved in the preparation of environmental lead samples. The Laboratory Training Program (see Sec. 1.6) Summary displays certain preparation routines that shall be completed with direct supervision. The Level III analyst retains that rating by performing metals analysis at least 8 hours per month with daily review by at least a Level I Analyst.

1.4.6 Sample Management

Education	Technical Experience	LTP Completion	Metals Participation
HS or equivalent, but prefer enrollment or completion of BS program	In-house training regimen.	1- Safety SOPs 2- HazMat SOPs 3- Sample Management Login Training	8 hours / month Periodic Review

IATL does not require that its sample Management staff be on-site full time. The technician does not have to participate in environmental metals analysis 40 hours a week, but must at least maintain an 8 hour per month minimum. Practical technical experience is not required by this position. The IATL in-house Laboratory Training Program (LTP) will be able to provide necessary training to all SM technicians. The LTP must include OSHA Safety and HazMat information and other technical items involved in the log-in of environmental lead samples. The Laboratory Training Program (see Sec. 1.6) Summary displays certain preparation routines that shall be completed with direct supervision. The Sample Management technician retains that rating by satisfying both QA Supervisor and Laboratory Director Performance Appraisals given annually.

1.4.7 Independent Operation

Staff Level	Minimum Requirement: Prep.	Minimum Requirement Analysis	Supervision Required	Maintenance
Level I	All Methods. 3 months	Flame/Furnace 6 months	10% QA Review	a) 20 hours/mnth b) 10 blind QC c) Lit/Meth Rvw d) QA Review
Level II	Env. lead only. 3 months	Flame only. 6 months	10% Level I, 30% QA Review	a) 20 hours/mnth b) 10 blind QC c) Lit/Meth Rvw d) QA Review
Level III	Env. lead only. 3 months	NA	50% Level I, 50% QA Review	a) 8 hours/mnth b) QA Review

In order for an analyst to operate independently, certain levels of technical competence must be achieved and recorded. Practical technical experience is required by all positions. The review process should provide immediate feedback to further enhance the technician's training. In order to operate/prep independently, the technician must maintain the above criteria. The positions may require knowledge of Methods used and instrumentation operated. Every position must be aware of OSHA Safety provisions and IATL Sample Login Procedures. As the Laboratory Training Program (see Sec. 1.6) indicates, certain levels may be achieved such that prep and analysis may be completed with little supervision.

1.5 Laboratory Job Descriptions

The following are approved job descriptions for all laboratory staff in the metals laboratory at IATL. The annual QA Manual/SOP review (see Sec. ii.2) also entails the review of these job descriptions. Periodic meetings with staff and management also serve to further modify, refine, and amend as needed these outlines. The job description is formally reviewed by Laboratory Director and employee at each yearly employee Performance Appraisal.

It is understood that the following job descriptions are outlines only. IATL is a small company with less than twenty technical staff. As such, all staff may have to wear many hats. It is not uncommon to have a Senior Analyst logging in samples, the Laboratory Director analyzing samples, or the company President assisting with Customer Service. At IATL we are all expected to act as a team, using our talents to the fullest.

Please also refer to the previous sections regarding minimum requirements for each position.

1.5.1 Laboratory Director

1.5.1.1 Accountability

The Laboratory Director reports directly to the President at IATL. The Laboratory Director is also held to comply with various Local, State, and Federal guidelines regarding safety, waste disposal, Quality Assurance programs, and general performance of the laboratory.

1.5.1.2 Job Summary:

The Laboratory Director establishes and coordinates all affairs concerning analysis of samples within the laboratory. This includes involvement with Marketing, Sales, Customer Service, Quality Assurance, Sample Management and Data Review, Training, Safety, and a strict integrity of analytical services.

1.5.1.3 Duties and Responsibilities:

The Laboratory Director's position can be divided into Technical / Laboratory Functions and Administrative Functions. (see below Sec. 1.5.1.4 and 1.5.1.5)

1.5.1.4 Laboratory Functions

1. Coordinates scheduling of incoming projects with Customer Service Representatives and laboratory technicians.
2. Assigns work to laboratory technicians.
3. Oversees all analytical operations on a daily basis insuring compliance to ISO standards, methodologies, and SOPs.
4. Reviews all QC data and implements recommendations of QA Coordinator where applicable.
5. Oversees Laboratory Training Program.
6. Oversees Laboratory Safety Program, Chemical Hygiene Plan, Right-To-Know Plan, HazMat Disposal, In-House Quality Assurance Air Monitoring.
7. Is able to prepare, analyze, and report all forms of analysis... AAS, PCM, PLM, TEM, etc.
8. Is responsible for technical updates to methodologies and the dissemination of information relative to analytical approach.
9. Presents and summarizes all QA reviews on a periodic basis.
10. Assures that PEs and PATs are performed as regular client samples, using the same methodologies and SOPs, and with no special involvement by technical staff.

1.5.1.5 Administrative Functions

1. Develops technical budgetary requirements.
2. Reviews invoicing and has input on Marketing decisions.
3. Reviews and approves timesheets and manages overtime usage.
4. Oversees technical staff and clerical staff scheduling.
5. Addresses intra-staff personnel problems and conflicts.
6. Reviews and evaluates prospective employees and records preliminary interview and Laboratory Training Program progress.
7. Evaluates staff and compile all technical and clerical staff Performance Appraisals in conjunction with potential compensation adjustments.
8. Negotiates annual maintenance agreements and contracts with equipment manufacturers.
9. Oversees the laboratory accreditation status and assumes maintenance of all subscribed memberships and affiliations.

1.5.2 QA Supervisor

1.5.2.1 Accountability

The QA Supervisor (or QA Officer, or QA Coordinator, etc.) reports directly to the Laboratory Director at IATL. The QA Supervisor is also able to submit notice of SOP and QA negligence to the Laboratory Director and directly to the President of IATL. In accordance with implications in the Code of Ethics, this position is charged to safeguard the client's concerns regarding analytical quality.

1.5.2.2 Job Summary:

The QA Supervisor reviews QA practices and in association with the Laboratory Director assures their promulgation at every level of the laboratory operation. This is accomplished with daily assignment of QC analyses, data review, and compilation of statistical QC data for further presentation and QA review.

1.5.2.3 Duties and Responsibilities:

1. Coordinates scheduling of QA analyses by technical staff.
2. Evaluates technical staff performance and reports findings to Laboratory Director.
3. Provides monthly calibration data for all instrumentation in a timely manner.
4. Provides monthly analyst review using established statistical review processes.
5. Has input into, and assists the Laboratory Director in the implementation of the Laboratory Training Program.
6. Is familiar with the Laboratory Safety Program, Chemical Hygiene Plan, Right-To-Know Plan, HazMat Disposal, and In-House Quality Assurance Air Monitoring.
- 7.
8. Assures that PEs and PATs are performed as regular client samples, using the same methodologies and SOPs, and with no special involvement by technical staff.
9. Assists the Laboratory Director concerning the laboratory accreditation status through various accrediting bodies.

1.5.3 Metals Analyst (Level I)

1.5.3.1 Accountability

The Metals Analyst (or AAS Analyst, Metals Technician, etc.) reports directly to the Laboratory Director at IATL. The QA Supervisor may also direct the QA efforts of individual staff with guidance from the Laboratory Director.

1.5.3.2 Job Summary:

All aspects of metals preparation and analysis by Atomic Absorption Spectrophotometry (Flame and Furnace) are required to achieve and maintain this highest level in the AAS department of the laboratory.

1.5.3.3 Duties and Responsibilities:

1. Remains proficient in all aspects of preparation technique as measured by QA PATs and review from QA Supervisor and Laboratory Director.
2. Remains proficient in all areas of analysis technique as measured by QA PATs and review from QA Supervisor and Laboratory Director.
3. Provides daily worksheets complete with required calibration data for all instrumentation in a neat and correct manner to be reviewed by the Laboratory Director.
4. Provides accurate and precise data with all significant figures and units correctly indicated on each proper form used as worksheets and on final reporting certificates.
5. Provides observations regarding unusual samples and their reactions to preparation practices on worksheets and informs Laboratory Director of any and all problems.
6. Is familiar with the Laboratory Safety Program, Chemical Hygiene Plan, Right-To-Know Plan, HazMat Disposal, and In-House Quality Assurance Air Monitoring.
7. Is able to prepare, analyze, and report all forms of analysis for metals using AAS both flame and furnace.

8. Demonstrates a working knowledge and technical awareness of all instrumentation and their routine care. Informs Laboratory Director of all instrument problems and notes these items in logs and on worksheets.
9. Maintains a safe and clean work area.
10. Reviews and pursues worthwhile information relative to technical methods and advances of this discipline.
11. Can adequately assist the performance of Level II and III analysts.

1.5.4 Metals Analyst (Level II)

1.5.4.1 Accountability

The Metals Analyst (or AAS Analyst, Metals Technician, etc.) reports directly to the Laboratory Director at IATL. The QA Supervisor may also direct the QA efforts of individual staff with guidance from the Laboratory Director.

1.5.4.2 Job Summary:

All environmental lead sample preparation and analysis by Atomic Absorption Spectrophotometry (Flame only) are required to achieve and maintain this level in the AAS department of the laboratory.

1.5.4.3 Duties and Responsibilities:

1. Remains proficient in environmental lead sample preparation technique as measured by QA PATs and review from QA Supervisor and Laboratory Director.
2. Remains proficient in environmental lead sample analysis technique as measured by QA PATs and review from QA Supervisor and Laboratory Director.
3. Provides daily worksheets complete with required calibration data for all instrumentation in a neat and correct manner to be reviewed by the Laboratory Director.
4. Provides accurate and precise data with all significant figures and units correctly indicated on each proper form used as worksheets and on final reporting certificates.
5. Provides observations regarding unusual samples and their reactions to preparation practices on worksheets and informs Laboratory Director of any and all problems.
6. Is familiar with the Laboratory Safety Program, Chemical Hygiene Plan, Right-To-Know Plan, HazMat Disposal, and In-House Quality Assurance Air Monitoring.
7. Is able to prepare, analyze, and report all forms of environmental lead samples using AAS flame.
8. Demonstrates a working knowledge and technical awareness of all instrumentation and their routine care. Informs Laboratory Director of all instrument problems and notes these items in logs and on worksheets.
9. Maintains a safe and clean work area.

1.5.5 Metals Analyst (Level III)

1.5.5.1 Accountability

The Metals Analyst (or AAS Analyst, Metals Technician, etc.) reports directly to the Laboratory Director at IATL. The QA Supervisor may also direct the QA efforts of individual staff with guidance from the Laboratory Director.

1.5.5.2 Job Summary:

All environmental lead sample preparation techniques are required to achieve and maintain this level in the AAS department of the laboratory.

1.5.5.3 Duties and Responsibilities:

1. Remains proficient in environmental lead sample preparation technique as measured by QA PATs and review from QA Supervisor and Laboratory Director.

2. Provides daily worksheets complete with initial set-up data (i.e mass of paint sample) in a neat and correct manner to be reviewed by the Laboratory Director.
3. Provides observations regarding unusual samples and their reactions to preparation practices on worksheets and informs Laboratory Director of any and all problems.
4. Is familiar with the Laboratory Safety Program, Chemical Hygiene Plan, Right-To-Know Plan, HazMat Disposal, and In-House Quality Assurance Air Monitoring.
5. Demonstrates a working knowledge and technical awareness of all instrumentation and their routine care. Informs Laboratory Director of all instrument problems and notes these items in logs and on worksheets.
6. Maintains a safe and clean work area.

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1.5.6 Sample Management

1.5.6.1 Accountability

Any laboratory staff technician or laboratory clerk may perform work as a Sample Management technician. These individuals report directly to the Laboratory Director at IATL.

1.5.6.2 Job Summary:

All sample receipt, sample rejection, sample management reports, workload postings and sample login procedures fall under this position. Though all technical staff are trained in this area, only trained laboratory personnel may enter and manipulate data through the Laboratory Information Management System (LIMS).

1.5.6.3 Duties and Responsibilities:

1. Inspects all incoming samples and corresponding paperwork (COC etc.) to assure integrity of sample is in accordance with established protocols set forth in the laboratory QA Manual and SOPs. These must be in compliance with EPA, DOT, and accrediting body practices regarding sample integrity.
2. Notifies Laboratory Director of all samples that fail to meet established criteria.
3. Demonstrates ability to submit a Sample Management Report.
4. Is familiar with the Laboratory Safety Program, Chemical Hygiene Plan, Right-To-Know Plan, HazMat Disposal, and In-House Quality Assurance Air Monitoring.
5. Can demonstrate proper emergency response to spills, leaks, or exposure episodes from compromised sample shipments and submits a report to the Laboratory Director.
6. Posts all samples on various boards and in log books, unique laboratory numbering and labels, the sample quantity, project and client information, turnaround, and any special information relative to analytical protocol.
7. Demonstrates sample archiving and retrieval practices.
8. Documents with signature (or initials) date and time all sample processes: receipt, login, prep, analysis, preliminary results report, data review, QA review and final Certificate of Analysis.

1.6 Laboratory Training Program

IATL maintains its Laboratory Training Program (LTP) for all levels of staff. The LTP starts at the interview process, is closely monitored through the first three month's of employment, and is thereafter routinely reviewed by the technician, QA Coordinator, and Laboratory Director. IATL has LTP summaries (see 1.6.# attached) that are used to outline the program and chart progress. The LTP is divided into the following components: 1) IATL Corporate and Human Resource Policies and the IATL Code of Ethics, 2) Safety Guidelines, and 3) Area of Discipline Training.

1.6.1 IATL Corporate and Human Resource Policies and the IATL Code of Ethics

The IATL Human Resource Policy Manual is available for review by the individual employee and should be reviewed before a formal offer of employment is tendered. IATL employs a Code of Ethics (see Sec. 1.3) that must be read, signed, and reviewed once per year by employee and employer during the Performance Appraisal period in December or January of each year. This Code of Ethics is also involved in the company interview process prior to employment, and is reviewed and signed as read and accepted by employee and employer when an offer of employment has been accepted. These are on file with the Laboratory Director and copied in the Laboratory Training Program Summary File.

1.6.2 Safety Procedures

IATL intends for all employees to work in a safe environment. The first day of employment at IATL is solely occupied with Health and Safety Training (see Section 10 & 11). This includes a full review (8 hours) of the following:

1. 29 CFR 1910 Chemical Hygiene Plan as mandated by OSHA.
2. Spill Control Procedures and demonstrations.
3. Fire Extinguisher demonstration.
4. NJ Right-To-Know Listing
5. First Aid Stations, Eye Wash, and Shower procedures
6. Review of Facilities and Fire Exits
7. ADP Security codes, police, and fire alarms, etc.

1.6.3 AAS Procedures

AAS training procedures are not initiated until after preliminary training in policies and safety are completed. Regardless of the experience and background of a new AAS technician, training for a Level III position must be concluded prior to advancement to Level II and Level I. Training for all levels is provided by a Level I analyst approved by the Laboratory Director. A total of 20 days of hands on documented experience is required before independent analysis of client samples is permitted. Lead analyst trainees must complete 4 independent runs containing at least 5 unknowns one of which must be an SRM/CRM. Recovery values must be within 10% 75% of the time.

**NO CLIENT SAMPLES MAY BE PREPARED AND ANALYZED
W/O COMPLETING THE REQUIRED LTP!**

1.6.3.1 AAS Technician Level III Training:

Analysis will take 8 hours with 40 hours additional review by the QA Coordinator and approval by the Laboratory Director and before advancement to a Level II training period. Level III technicians are only responsible for the safe organized preparation of environmental lead samples by the strict adherence to established protocols. The training includes the following 8 hour presentation:

- 1.6.3.1.1 Chem Prep Room Introduction
- 1.6.3.1.2 Ventilation Procedures
- 1.6.3.1.3 Personal Protection Equipment
- 1.6.3.1.4 Spill Control
- 1.6.3.1.5 Glassware Cleaning Procedures
- 1.6.3.1.6 Analytical Balance Calibration and Usage
- 1.6.3.1.7 Initial Prep Set-up and Sample Management Considerations
- 1.6.3.1.8 Standards Preparation I (Reagents, Spikes, CCV, LCS, Blanks, Dups)
- 1.6.3.1.9 Acid Digestion Procedures I
- 1.6.3.1.10 Acid Digestion Procedures II
- 1.6.3.1.11 Acid Digestion Procedures III
- 1.6.3.1.12 NIOSH 7082
- 1.6.3.1.13 NIOSH 0900
- 1.6.3.1.14 NIOSH 7105
- 1.6.3.1.15 ASTM D 3335-85a
- 1.6.3.1.16 Acid Waste / HazMat Procedures
- 1.6.3.1.17 PRACTICE RUN with 100% Supervision

The training includes a complete review of the entire laboratory SOP and QA procedures for lead preparation. As stated in previous Sections of this Manual, Level III staff are supervised directly and QA reviewed frequently.

1.6.3.2 AAS Analyst Level II Training:

Analysis will take 8 hours with 16 hours additional review by the QA Coordinator and approval by the Laboratory Director and before advancement to a Level I training period. Level II technicians are responsible for the safe organized preparation of environmental lead samples by the strict adherence to established protocols. They are also trained to analyze these samples by AAS flame procedures only. The training includes the following 8 hour presentation:

- 1.6.3.2.1 Initial Instrument Set-up and Sample Management Considerations
- 1.6.3.2.2 Standards Preparation II
- 1.6.3.2.3 PE AAnalyst 400 Flame Procedures, Alignment, and Optimization
- 1.6.3.2.4 Calibration Curve
- 1.6.3.2.5 Verification Standards
- 1.6.3.2.6 Continuing Calibration Standards and Blanks
- 1.6.3.2.8 Duplicate Analysis
- 1.6.3.2.9 Spike Analysis
- 1.6.3.2.10 Analysis and Reporting of Instrument Readings / Documentation
- 1.6.3.2.11 Dilution Procedures
- 1.6.3.2.12 PE AAnalyst 400 Instrument Problem Solving, Servicing
- 1.6.3.2.13 Data Reduction for Environmental Lead Samples, calculations, Reporting
- 1.6.3.2.14 Instrument Shut-Down Procedures
- 1.6.3.2.15 HazMat Procedures
- 1.6.3.2.16 QC Calculations and Reporting
- 1.6.3.2.17 PRACTICE RUN with 100% Supervision

The training also includes a complete review of all SOPs and QA requirements for preparation of environmental lead samples and the analysis by AAS Flame only. Ongoing training is provided for Level II technicians. The degree of ongoing training

is determined by the QA results submitted. Recommendations by the QA Coordinator, Level I Analysts, and the Laboratory Director for outside training are also considered. IATL has provisions for Staff Development that can include partial tuition reimbursement and outside seminar course schedules in the annual Training Budget. Most often this is the Perkin-Elmer course for flame analysis (a 72 hour program). It is recommended that technicians who have completed required Level II criteria and maintain this level for at least a year are given the opportunity for Level I training.

1.6.3.3 AAS Analyst Level I Training:

Analysis will take 16 hours with 16 hours additional review by the QA Coordinator and approval by the Laboratory Director and before the independence given a Level I Analyst. Level I technicians are responsible for the safe organized preparation of environmental lead samples by the strict adherence to established protocols. They are also trained to analyze these samples by AAS flame procedures. A Level I Analyst will also be trained in all metals analysis beyond environmental lead samples. This includes potable water, wastewater, sludge, and misc. materials by both flame and furnace techniques. The training includes the following 8-hour presentation:

- 1.6.3.3.1. Literature Review of:
Pb-Based Paint Laboratory Operations Guidelines TPB/EPA
EPA SW846, 7420 40 CFR Part 50 App. G,
EPA SW846, 7421 EPA Method 239.2 / ASTM 3559-03(D)
EPA SW846, 3050A 40 CFR 141.11
- 1.6.3.3.2. Initial Instrument Set-up for Furnace AAS and
Sample Management Considerations
- 1.6.3.3.3. Standards Preparation III & IV (other metals)
- 1.6.3.3.4. Perkin-Elmer 2100 Furnace Procedures,
Alignment, Auto-Sampler and Optimization
- 1.6.3.3.5. Calibration Curve
- 1.6.3.3.6. Verification Standards
- 1.6.3.3.7. Continuing Calibration Standards
- 1.6.3.3.9. Duplicate Analysis
- 1.6.3.3.10. Spike Analysis
- 1.6.3.3.11. Analysis and Reporting of Instrument Readings / Documentation
- 1.6.3.3.12. Dilution Procedures
- 1.6.3.3.13. Perkin-Elmer 2100 /HGS 700 Instrument Problem Solving, Servicing
- 1.6.3.3.14. Data Reduction for Potable/Non-Potable Water Samples,
Calculations, Reporting
- 1.6.3.3.15. Instrument Shut-Down Procedures
- 1.6.3.3.16. HazMat Procedures
- 1.6.3.3.17. QC Calculations and Reporting
- 1.6.3.3.18. PRACTICE RUN with 100% Supervision

The training also includes a complete review of all SOPs and QA requirements for preparation of all samples and the analysis by AAS Flame and Furnace. Ongoing training is provided for Level I technicians. The degree of ongoing training is determined by the QA results submitted. Recommendations by the QA Coordinator, Level I Analysts, and the Laboratory Director for outside training are also considered. IATL has provisions for Staff Development that can include partial tuition reimbursement and outside seminar course schedules in the annual Training Budget. Most often this is the Perkin-Elmer course for furnace analysis (a 48 hour program). It is recommended that technicians who have completed required Level I criteria and maintain this level for at least a year are given the opportunity for further training.

1.7 Demonstration of Capability

IATL requires certain levels of training in order for laboratory technicians to perform various levels of analysis. Indeed, this QC/QC manual outlines several times the minimum requirements (Section 1.4) needed for employment at IATL. This includes education, laboratory experience, internal and outside training (Section 1.6) and hours of training needed to maintain analytical competence at each level. Furthermore, detailed job descriptions (Section 1.5) are required for each position in the laboratory. Finally, annual performance appraisals and laboratory evaluations for each individual are documented annually in each analyst's personnel file and our Laboratory Training Program records. These records are signed by Laboratory Management and the analyst.

Regardless of this level of redundancy, we have added another level of documentation demonstrating technical competence of our laboratory analysts. Therefore, in accordance with NELAC Section 5 Appendix C, IATL has instituted both Initial Demonstration of Capability and Continuing Demonstration of Capability documentation. These are recorded on forms provided by NYSDOH.

The Certification Statement is reviewed and signed by Laboratory Management. It lists the analyst's name, matrix, methods, and parameters that competence has been documented through our LTP (Section 1.6). It also indicates that certification has been demonstrated using established methods and that validation of competence can be reconstructed.

This form will be used when new levels of analysis are successfully achieved through the LTP (Initial Demonstration of Capability). Each analyst's "Continuing Demonstration of Capability" is documented by the daily QC performed throughout the year.

A copy of this form can be found at the end of this section of our SOP QA/QC Manual.

1.8 Notification of Personnel Changes

In the event of Personnel changes written notification will be drafted and mailed to the AIHA and any other accreditation bodies requiring so. This will be done within 30 days of the change in personnel.

2.0 Sample Management

The following procedures apply to all samples received by IATL for analysis. All sample receipt, posting, batching, and login are done in the Sample Management Room (see facilities floor plan).

2.1 Sample Tracking and Receiving:

IATL operates routinely from 06:00 until midnight Monday through Thursday, 06:00 until 22:00 on Fridays, and from 07:00 until 17:00 on Saturdays. Sunday, Holidays, and off-hours operations must be approved by the Laboratory Director or the Senior Laboratory Technician on-call. During operating hours, sample receipt is from the office Reception area. If the samples are "walk-in", then required chain-of-custody and /or sample logs are signed and dated received by office personnel. Copies are then made for the client, and samples are transported to the Sample Management Room. IATL also receives several daily deliveries from carriers (i.e. UPS, FedEx, USPS, etc.) throughout the day. These containers are also taken to the Sample Management Room. Samples delivered outside of the hours of operation are deposited in a Drop Box located in the rear of the building. Both slot and key entry are provided to this box. Each morning, noon, and evening this Drop Box is checked for any samples that may have been left by clients.

Prior to analysis samples are batched and logged in. The batching process records in LIMS all pertinent information regarding client, project, material type, analysis, and turnaround times. The login person signs the client paperwork to maintain the chain of custody. The Batch Sheet includes time/date and condition of samples at log in. These two groups of information are married to a unique tracking number (aka IATL number, or ID number, or laboratory ID number, etc.) that shall be used to identify the sample prior to, during, and after analysis. The tracking number shall be clearly placed on the sample container using pre-printed labels. The tracking number shall also be included in the client report and on all worksheets pertaining to the sample. The sample numbers are to be carried through to all glassware, dilution tubes, and intermediary sample vessels. All samples are immediately secured in the laboratory after receipt to ensure chain-of-custody.

In the case of water samples additional steps are required at the time of log in. Samples must be preserved using high purity grade nitric acid upon receipt unless this is performed in the field. Each samples color, pH, and odor are checked and recorded in the 'AAS H₂O Sample Log', at this time also. Turbidity is to be checked prior to analysis. For samples with turbidity greater than 1NTU sample digestion may be required.

In the event of sample overbooking, samples may be subcontracted out to a previously assessed laboratory. The client is first notified by phone of the situation and offered several options. Samples may be returned, samples can be given a longer turn around time, or samples can be subcontracted. Should subcontracting be chosen, a written statement to this affect, including the subcontractor's name, shall be submitted to the client by facsimile. Their written agreement is then returned by facsimile and samples are transferred for analysis.

2.2 Sample Inspection and Rejection Criteria:

Once in the Sample Management Room, trained technicians open and inspect packages prior to sample login. Samples shall not be accepted for analysis unless submitted in an appropriate container. Acceptable containers include 4mil zip-lock polyethylene bags, snap top vials, and other individual containers that meet EPA criteria, can be labeled by either indelible ink or a printed label, are re-sealable, do not cross-contaminate paperwork, or in any way interfere or react with the sample analyte to be analyzed. The client should be urged to submit only an appropriate amount of material necessary to perform the analysis and as mandated by the analytical method (see Sec. 5 & 3.5). Air sample cassettes and charcoal tubes must also be submitted in zip-lock polyethylene bags. Water samples that may need preservatives added are introduced to the login procedure first.

If there exists a problem with the packaging of the samples a Sample Management Report is completed and attached to client paperwork.. A Shipping, Packaging, Chain-of-Custody flier is also attached to the client's paperwork. (see attached) Both documents act as tools to document any observations, deficiencies, or problems that are noted upon receipt of the samples. These tools are utilized to prevent improper sample packaging by the client in the future. Samples may be rejected (VOIDED) if proper packaging etc. are not met. *Information is available to clients regarding sampling materials, preservatives, sampling containers, and shipping instructions.*

Water bottles, paper towels, spill control kits, and respirators are immediately available if a breach occurs at the Sample Login area. (see Sec.3.2 & 10)

Upon receipt of the sample, the chain of custody is reviewed to ensure that the client information matches the information on the sample and that an appropriate amount of information (volumes, air flow rates, areas sampled etc.) is available to allow proper reporting of the sample results. Laboratory personnel receiving the sample must sign the sample transmittal along with recording the date and time. If an appropriate transmittal is not submitted with the sample, one will be initiated at the time the samples are received. Many times the client Customer Service Representative will need to call the client to request additional information, turnaround times, or other clarifications. A Faxed hardcopy request from the client of changes or additional information is required to be attached to existing paperwork relating to each sample batch.

Transmittal forms will at a minimum, contain the following information:

- i. Client Sample Number
- ii. Identity of collector
- iii. Date and time of sample collection
- iv. Date and time of custody transfers
- v. Identity of person accepting custody
- vi. Date and time of initiation of analysis
- vii. Identity of persons performing analysis
- viii. Name of laboratory performing analysis
- ix. Method of analysis
- x. Turnaround Time for laboratory services.
- xi. Method of result transmittal (i.e. FAX, phone number, pager number etc.)

Samples shall also be examined by the laboratory technician to determine their acceptability for analysis. Samples improperly packaged, exhibiting cross-contamination, or that are in a form unsuitable for analysis shall be rejected. Dust samples collected on tape are unsuitable for analysis. Air samples not on the proper media are unacceptable. Water samples in improper packaging or with turbidity values >1.0NTU may be rejected as potable water samples. The Laboratory Director shall confirm any sample found to be unsuitable for analysis and promptly inform the client. A Sample Management Report must also be attached.

2.3 Laboratory Information Management System

IATL employs a Laboratory Information Management System (LIMS) customized for our utilities by Zumatrix Inc. This system is maintained by IATL with Eric Snyder, President acting as the technical systems manager (TSM) for the LIMS. There are 16 LIMS stations within the laboratory. Security features limit the usage of users to certain functions.

The LIMS offers electronic sample login, sample description, location, and comments fields. IATL has customized reports and Certificate of Analysis (COA) with analytical results fields and QC result fields that meet all requirements of NIST, NYSDOH, NJDEP, and AIHA. Disclaimers relative to sample condition and limitations of analysis are also printed upon these reports. The LIMS will accept invoicing information and client database. The LIMS is limited by human error and therefore complete review and proofing by authorized laboratory staff (e.g. Laboratory Director, QA Coordinator, other designee) must be performed on all results prior to release.

Any corrective actions taken that will effect analytical data, will be recorded in control charts, noted on worksheets, and signed-off by Analyst and QA Coordinator. Some of these raw data edits may precede any computer entry. Computer data entry files that are changed or edited might be QA data and final computer generated COA reports. Only certain laboratory staff are privileged and security permitted to access these computer files. Documentation of any changes can be listed on the LIMS log by date of change, who accessed and edited, and who approved or validated any changes.

There is a back-up of the LIMS data each day (see Sec.2.3.1). These drives are archived in a secure location.

After analysis the client receives the following: Invoice, Report (COA) (see Sec. 9), Approval with Laboratory Director and Analyst signatures, Original Chain of Custody (COC), and Client sample logs.

IATL retains in its hardcopy files, copies of the following: Invoice, COA, COC, raw data, QA data, documentation, AAS Run Information, and Preliminary Fax Results. All hardcopy and tape back-up files are held indefinitely. A Public Storage facility is rented to archive files.

2.3.1 Daily LIMS Back-up

The Laboratory Information Management System (LIMS) resides on a local area network allowing access to the LIMS software at various locations throughout the company. The company has established a daily backup routine to ensure the survival of analytical data in the event of a malfunction of the server or catastrophe such as fire or flood.

Standard operating procedures call for a complete backup of the Domain Controller and the SQL Server. A system using external USB hard drives for each day of the week and each Friday of the month is used. The system also contains a compare function that verifies all files have been accurately copied. Each day the previous day's backup is taken off site. More detailed information for each of the above procedures is contained in the operating manuals.

2.4 Sample Handling

Prior to handling possible lead-containing materials, all laboratory staff will be instructed in the hazards of lead, the 29CFR (OSHA) 1910.1025 regulations, and the proper precautions for working with lead-containing materials. Contamination control samples via wipes will be analyzed daily. In-house quality assurance air monitoring samples are run monthly. Sealed containers containing suspected lead-containing materials shall only be opened in a properly ventilated hood. This hood will contain a continuous flow of negative air exhausted through a HEPA filter to prevent possible lead particle release into the air. A tabletop Plexiglas enclosed hood equipped with a HEPA filtration unit is provided. All HEPA filtration hoods used in sample preparation will be visually inspected and tested with a velometer for proper airflow on a semi-annual basis and the information will be logged in the calibration notebook. Other personal protective equipment and procedures are discussed in the Laboratory Training Program. Enforcement of sample handling requirements may include a reduction in analyst Level, Performance Appraisal deficiencies, and possible termination of employment.

2.5 Sample Retention and Archiving

For the analysis of air and dust wipes the entire sample is consumed in preparation. Paint, soil, and water samples many times have unused portions that need to be archived. Paint samples are retained for 12 months, soil samples for 12 months, and water samples for 3 months. These are stored either at the IATL site (three in-house locations for temporary archiving), or one of two Public Storage warehouse facilities. See Section 10 & 11 for waste disposal procedures for these unused portions of samples.

Digests of samples are kept for 15-30 days. The digests are stored in racks of 50ml centrifuge tubes with a screw cap. The racks are stored in a secure, ventilated, temperate and humidity controlled room.

If QA or clients require a reanalysis of samples, the digest can be found within this time frame. Recent in-house studies indicate that <2% gravimetric loss from evaporation results from this holding time. Once a month these archived tubes are disposed of as acid containing hazardous waste (see Sec. 11).

3.0 Instrumentation / Facilities

IATL comprises 12,000 square feet in an industrial office complex. This facility has been customized to IATL's laboratory requirements. It includes separate rooms for analytical disciplines. Thus sample receiving, sample management, optical, analytical electron, and metals analysis are all in their own individual rooms.

Comfortable settings have been included to facilitate the best working conditions for the laboratory staff. Ventilation, storage, and safety equipment are detailed in this section.

The attached floor plans include our support area, offices, reception area, conference room, communications center, bathrooms, technical office library, break room, temporary sample archives, file archives, as well as the analytical laboratory details.

3.1 Floor Plans / Safety Equipment

Please note the attached floor plan. This will indicate the fire extinguishers and other safety equipment as noted below:

Item:

- Laminar Class 100 HEPA hood
- Small Exhaust Hood
- Chemical/Acid Fume Hood
- Small Exhaust Hood
- AAS Exhaust Hood
- HEPA Vacuum for Spill Control
- HEPA Hoods for PLM analysis
- HEPA Hoods
- First Aid Kit
- Security Panel with Alarms
- Eyewash
- Fire Extinguisher
- Material Safety Data Sheets
- Chemical Hygiene Plan
- Water chillers
- Oxygen
- Air and Liquid Nitrogen
- Deionized/MicroFiltered Water
- Goggles, Eyewear
- Disposable Gloves
- Respirators
- Spill Control:
 - 17 organic pads PolyZorb
 - 20 acid pads PolyZorb
 - Sodium Bi-Carbonate Powder
 - 1 multi-sorb snake from Pig Co.
 - 2 spill kits from

Location(s):

TEM Air Prep Room
 TEM Air Prep Room
 Chem Prep Room
 Chem Prep Room
 AAS Room
 Optical Rooms
 Optical Rooms
 Login
 Login
 Front & Rear Main Exits
 TEM Misc Prep & Chem Prep Rooms
 5 in laboratory, Hallways etc.
 Chem Prep Room & Lab Conference Room
 QC Coordinator and Lab Director's Offices
 Service Room
 TEM Air Prep Room
 Sample Archive Room
 Sample Archive Room
 Chem Prep Room
 Chem Prep Room
 Chem Prep Room
 TEM Misc Prep
 Chem Prep Room
 Chem Prep Room
 TEM Misc Prep
 TEM Misc Prep

3.2 Chem Prep Room Safety Procedures

The attached detail of the Chem Prep Room is used to assist the technician in locating equipment, glassware, safety items, emergency controls, storage of reagents, standards, etc. Laboratory Safety is included as a part of the Laboratory Training Program. As such the technician, regardless of Level, must always be aware of the potential for serious hazards when dealing with acid and other chemicals. A posting of spill controls, eyewash procedures, and ventilation notices are clearly visible within this room. Additionally, eating, drinking, and smoking are not permitted in the analytical portion of the lab.

NO SAMPLE PREPARATION SHALL BE DONE UNLESS THE FOLLOWING IS IN PROPER WORKING ORDER:

- 3.2.1. At least one Chemical Fume hood must be operational: capable of pulling 100cfm, lighted, and without leaks.
- 3.2.2. The exhaust ventilation must be working at least at 20cfm.
- 3.2.3. All Personal Protective Equipment (gloves, goggles, lab coat etc.) must be worn.
- 3.2.4. Eyewash operational.
- 3.2.5. Spill control immediately available.
- 3.2.6. Emergency Shower operational.

3.3 Ventilation / Fume Hood SOPs

The floor plan notes 14 hoods in operation at IATL. These range from customized exhaust hoods to multi-functional acid fume hoods. The Chemical Prep & AAS rooms utilize five of these hoods. There is a column in the "Balance Log" for notes on each hoods function. Any problems are to be noted.

HEPA filters are changed annually under strict control and disposal conditions.

IATL contracts MicroClean to perform semi-annual certification of all non-alarmed hoods (1st & 3rd Quarters) and annual for alarmed hoods (1st Quarter only). AAS analysts are able to observe daily the quality of air flow during the preparation of dust wipe samples. As ghost wipes breakdown they create an orange-brown gas which demonstrates the direction and rate of the air flow. PLM and PCM analysts perform daily checks for their specific work areas. Note that the airflow monitoring is performed using an Alnor Series 6000 Velometer calibrated by an Industrial Hygienist.

NO SAMPLE PREPARATION SHALL BE DONE UNLESS AT LEAST ONE ACID FUME HOOD IS IN PROPER WORKING ORDER:

All manufacturer's information, parts catalogs etc. are available and stored in the Laboratory Directors top file drawer under "Fume Hood / Ventilation". IATL uses MicroClean and Labconco to service all hoods. Vendor information is found in the same file mentioned above. A list of fume hoods follows:

3.3.1 Fume / Exhaust Hoods

<u>Quantity:</u>	<u>Location:</u>	<u>Hood Manufacturer:</u>	<u>Specifications:</u>	<u>Flow:</u>
3	PLM 2 1996	Flow Sciences 3060 HEPA	34Wbase" X 22"Wtop 17"HX26"D	100CFM
1	PLM 2 1997	Flow Sciences 3060 HEPA	34Wbase" X 22"Wtop 17"HX26"D	100CFM
2	PLM 1 2000	Flow Sciences 3060 HEPA	34Wbase" X 22"Wtop 17"HX26"D 0.3umHEPA	100CFM
2	PLM 3 2006	Flow Sciences 3060 HEPA	34Wbase" X 22"Wtop 17"HX26"D 0.3umHEPA	100CFM
1	TEM Air Prep 1989	Labconco Purifier II 008526,172284	Phase I Hood 115 Volts 60Cycle,HEPA filter	200CFM
1	TEM Misc Prep 1995	Kewaunee Scientific 001116,	Chemical Fume Hood 72"Wx49"HX37"D	220 CFM
1	PCM 2000	Enviroco Class 100,	HEPA Fume Hood 47"Wx36"HX31"D	220 CFM
1	AAS 2007	Costa Rihl	Inline Exhaust Hood Flame & Furnace	75 CFM
1	TEM Air Prep 2007	Costa Rihl	Inline Exhaust Hood Flame & Furnace	75 CFM
2	Chem Prep 2007	Labconco Protector 3 hp roof mounted	Fume Exhaust Hood 72"Wx49"HX37"D	119 CFM

3.4 Atomic Absorption Spectrophotometer

IATL employs a Perkin-Elmer AAnalyst 400 as the primary Flame Analysis Instrument. The Perkin-Elmer PE 2100 Atomic Absorption Spectrophotometer (AAS) is capable of both flame and graphite furnace modes of operation but exists primarily for furnace analysis and as a back up flame instrument. Both instruments house multiple lamps and are able to adequately handle all metals analyses performed at IATL. In the event of instrument malfunction beyond the repair capabilities of the staff, the manufacturer is contacted and a service call scheduled. No instrument is to be used until the operator can ensure reliable results.

As of this printing... over 94% of the metals analyses concern environmental lead samples by flame AAS. Another 5% are either water samples or environmental lead samples that require the furnace AAS orientation. The 1% balance of this discipline concern other metals in various matrices analyzed by either flame or furnace. The metals that IATL are qualified to analyze include: Cd, Cr, Pb, and Zn.

Each instrument has an accompanying daily log with a list of completed maintenance. Routine maintenance is limited to periodic cleaning of the aspirator, mixing chamber, and burner assembly. The log also indicates who performed what operation, when, and other details of daily operation. This document also indicates details related to standards preparation.

IATL has our AAS instrument under a service agreement contract (see attached) with the manufacturer. The agreement calls for unlimited emergency calls. Response time is usually within 24 hours. A copy of this agreement is located in the Laboratory Director's file top draw under PE Current. Phone numbers of the PE technician are posted in the AAS Room along with serial numbers for each component of the instrument. All associated manuals are also located in the AAS Room.

Perkin-Elmer AAnalyst 400 & 2100 consist of ancillary components listed below:

- 3.4.1. Nebulizer with a flow spoiler and burner head.
- 3.4.2. Internal regulating devices capable of maintaining constant oxidant and fuel pressures.
- 3.4.3. Optical system capable of isolating the desired wavelength of light radiation.
- 3.4.4. A detector and photomultiplier tube.
- 3.4.5. Adjustable slit.
- 3.4.6. PC interface for instrument control and data storage
- 3.4.7. Hollow cathode lamp capable of producing a wavelength of 283.3 nm. (Pb)
- 3.4.8. AS-70 Auto Sampler with 40 stations for sample vials
- 3.4.9. HGA 700 Furnace Control
- 3.4.10. Okidata Microliner Printer
- 3.4.11. Constant cylinder purge gas: Argon

The set-up, operation, routine maintenance, and other instrument related parameters are covered in the Laboratory Training Program (LTP) for Level II and III Analysts.

- PE 2100 AND AANALYST 400 OPERATIONS MANUALS AVAILABLE IN AAS ROOM
- OPERATION OF THE AAS IS COVERED IN SECTION 6
- IF EQUIPMENT IS FOUND TO BE DEFECTIVE (see Section 4.5) THEN AAS MAY NOT BE USED UNTIL SERVICE IS PERFORMED BY CERTIFIED TECHNICIAN. THE OUT-OF-SERVICE INSTRUMENT CAN NOT BE RETURNED TO SERVICE WITHOUT DEMONSTRATING ACCEPTABLE PERFORMANCE.
- OUT OF SERVICE SIGNS MUST BE AFFIXED TO ANY INSTRUMENT UNTIL REPAIRED.

3.5 Limits of Quantitation

When a client sends a sample to IATL for analysis they expect that the result supplied to them by the laboratory will be truly representative of that material's or that matrices composition for the analyte tested. The client should be aware, and it may be IATL's function to assist in this education, that there are several factors that may influence the degree of accuracy and precision of the laboratory result. In this SOP and QA Manual (Sec. 7.0) IATL discusses how they monitor and measure both quality objectives of precision and accuracy. A brief discussion of limits of quantitation must be considered.

Limits of quantitation (LOQ) encompass field sampling variables as well as instrument, method, and laboratory originating limitations.

3.5.1 Field Sampling LOQ

IATL is NOT involved in any field sampling, but realizes that this plays a major factor in LOQ determination. As such, IATL provides clients with copies of established sampling protocol from ASTM, EPA, NIOSH, and other published sources. IATL also trains its technicians to recognize that sampling will effect laboratory results. IATL technicians have a thorough understanding of field sampling and its relationship to the non-uniformity of some samples, associated materials that may interfere with the homogeneity of a matrix, and the effects of minimum sample sizes.

3.5.1.1 Sample Size

The minimum sample size collected is based in part upon the ability to detect a metal at the action level recommended in various guidelines with a defined degree of confidence. The recommended sample size by HUD, NIOSH, CDC, ASTPHLD and CPSC to achieve confidence levels are indicated below:

Matrix	Action Level	Sample Size Required
Paint Chip - HUD	0.50% by weight	300.0 mg
Paint Chip - CPSC	0.06% by weight	1,000.0 mg
Soil - EPA	200 mg/kg	1500.0 mg
Dust/Wipe - HUD	100 µg/ft ²	1.0 ft ²
Dust/Debris - ASTPHLD	100 µg/ft ²	300.0 mg

The absolute minimum sample sizes for environmental lead samples to be analyzed by AAS flame are indicated below.

Matrix	Detection Level	Sample Size Required
Paint Chip - HUD	0.01% by weight	50.0 mg
Paint Chip - CPSC	NA	NA
Soil - EPA	40 mg/kg	250.0 mg
Dust/Wipe - HUD	10 µg/ft ²	1.0 ft ²
Dust/Debris - ASTPHLD	10 µg/ft ²	100.0 mg

3.5.1.2 Wipe Material

In accordance with EPA 403 Final Rule (40 CFR 745.63) IATL requires that all wipe samples of settled dust be collected on materials meeting ASTM E1792 specifications. Clients not using appropriate materials are notified via fax and/or phone to ensure that future submittals are compliant. Results for inappropriate wipe materials are provided on Certificates of Analysis without mention of applicable accreditation.

Wipes must also be received by the laboratory with at least one blank dry (to test the wipe material) and another blank that has only been wetted (to test the water).

3.5.1.3 Paint Chips

The HUD-EPA guidelines provide adequate sampling protocol. The laboratory is aware, notates the presence of, and is able to communicate to the client when samples are received that contain too little sample size (see above) and have associated debris and other substrate material present. These matrix interference debris may be wood, plaster, or metal associated with the painted surface or they may be debris found where the paint chips were collected. Because the process involves an initial gravimetric determination of mass, a homogeneous material is recommended.

3.5.1.4 Dust Vacuumed Samples

The HUD guidelines do not suggest protocols, nor are there any published protocols for the collection of vacuumed dust. The client must supply the laboratory with any SOPs for field sampling prior to the laboratories analyses.

3.5.1.5 Soil Sample

The HUD guidelines and EPA SW846 methods have protocols for this sampling. The collection should detail location, depth, soil conditions, and distance from structures clearly. A series of blanks may be required.

3.5.2 Method Detection Limit

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

The procedure used is designed for applicability to a wide variety of sample types ranging from potable water to paint. The method for determining an MDL for an analytical procedure consists of digesting and analyzing seven replicates of a matrix in the same manner as routine samples. The matrix is to be spiked prior to digestion at a level near the expected MDL. The spike level must be greater than the MDL but not more than 10 times. The actual calculation to determine the an MDL is the multiplication of the Standard Deviation of the seven replicates by the value 3.143 (*"Tables of Students' T Values at the 99% Confidence limit"*) Subsequently the Reporting Limit must be greater than or equal to 2 times the MDL. The MDL determination procedure requires a complete, specific, and well-defined analytical method. It is essential that all of the steps utilized to process client samples be incorporated into the MDL study.

IATL performs an annual MDL study for each matrix of analysis in accordance with the requirements set forth by the AIHA. Additional studies are performed following instrumentation updates or method amendments.

All MDLs are reviewed each January, verified by QA procedures (see Taylor '87), and summarized in the annual QC Report. Linear calibration ranges are established and routinely verified for each method. (see also Sec. 5.7)

3.6 Muffle Furnace

IATL employs a muffle furnace with closed ceramic and porcelain crucibles. Temperature settings are within 5% range as per EPA SW846-7420 and 7421. The furnace is routinely calibrated using Omega temperature standards in pellet form. The furnace is under a chemical fume hood. Appropriate safety gear must be worn when operating any muffle furnace.

3.7 Analytical Balance Operations and Calibration

For gravimetric determinations, IATL employs a Sartorius model CP 124S Analytical Balance. This balance is cleaned, serviced, and re-certified annually. IATL uses a set of NIST Class S-1 weights for calibration verification. Calibration verification is to be performed daily prior to use. In the event of balance readings deviating by more than 0.002 g the balance is to be recalibrated using the Autocal feature. Following auto-calibration verification is to be performed again. If readings still deviate by more than 0.002 g calibration using a 50g weight should be performed. In the case of continued bad readings the balance will be taken out of service until properly serviced and returned to acceptable performance.

The weight set is from the Troemner Company of Philadelphia. They are individually registered. All weights are returned annually to the manufacturer for re-certification and tolerance testing.

3.8 Compressed Gases and Supply Water

Please refer to the facilities floor plan (Sec. 3) for the location of all gases. IATL employs several compressed gases. IATL maintains only a single back-up of each gas type to limit inventory and reduce the potential for safety hazards. All gases are secured using chains or other proven stand-alone devices.

The Laboratory Training Program (LTP) addresses the safety consideration for the handling of these gases. Special protective gear is required when handling the Liquid Nitrogen. Approved service lines and regulators are also utilized for all Oxygen.

Several TEM and AAS preparation applications require deionized and micro-filtered supply water. IATL uses a triple-mixed resin water purification system under contract through Siemens. The system is rated at 0.5 – 20 Mohm Resistivity and 0.1µm particulate.

3.8.1 Supply Water Conductivity / Resistivity

Deionized water is checked continually by a Thornton in-line conductivity meter. To ensure its performance it is certified / recalibrated annually by US Filter. Additional checks are performed on an as needed basis prior to water sample digestion. This is done using a secondary conductivity meter and probe to reanalyze a 100 ml aliquot of supply water. This confirmation is to be noted in the 'AAS Lead In Water Log' book. In the event that there is inconsistency between the two meters US Filter must be contacted and the meter must be recalibrated.

3.9 Ancillary Equipment

IBM Compatible Personal Computers, Pentium class processors running Windows 98

Autopipetters, 5-50 μL , 40-200 μL , 200-1000 μL , and 1-5 mL Finnpiptette.

Reagents (All chemicals will be reagent grade or better.):

- Nitric acid (HNO_3), concentrated.
- Calibration thermometer.
- Assorted polypropylene tubes and bottles.

3.10 Pipette Calibration

IATL uses both bottle mounted auto re-pipettes and adjustable volume Finnpiptettes for dispensing all liquid reagents. To ensure consistently accurate measures of volume all pipettes are checked quarterly at a minimum. Finnpiptettes should be calibrated prior to the preparation of standards at the specific volume to be dispensed when possible. Having more than one Finnpiptette allows the use of specific pipettes for a single volume. The auto re-pipettes cannot be recalibrated. They are instead marked at the settings that provide the volumes commonly dispensed.

3.10.1 Finnpiptette Calibration

- 1) Enter all information into the Pipet Calibration worksheet before starting, (i.e.; name, date, pipette serial number, capacity, and calibration volume.)
- 2) Check that the balance has been calibrated or verified within the last day. Verify calibration or calibrate as needed.
- 3) Place a 50 ml centrifuge tube on the balance and tare.
- 4) Using Deionized water at room temperature dispense into the centrifuge tube. Be sure to get a complete and air-free draw and dispense completely and quickly into the tube. Close the balance window and allow a few seconds to settle. Record each weight as displayed on the balance. Tare and repeat 5 times.
- 5) Determine the average wt/volume. Adjust the pipette as needed to achieve accuracy of not more than 2%.
 - a) Adjusting Finnpiptettes:
Using the adjustment tool, turn the volume adjustment ring at the base of the plunger slightly. (Clockwise for more volume)
- 6) Record the weights in the Pipet Calibration spreadsheet. If the row of data for the pipet is shaded it indicates either that the weights are too disparate or that the accuracy was greater than 2%. Repeat the procedure until results fall within acceptable limits.

3.10.2 Auto Re-pipette Calibration

- 1) Enter all information into the Calibration Log before starting (i.e.; name, date, pipette serial number, capacity, and calibration volume.)
- 2) Adjust the volume setting to the desired volume.
- 3) Select a class A graduated cylinder of a capacity about five times that of the volume to be dispensed.
- 4) Using the same technique used in sample preparation dispense five times into the graduated cylinder.
- 5) Adjust the volume setting as needed to achieve the desired volume and repeat steps 3 and 4 until accurate.
- 6) Mark the slide bar at the top and bottom of volume setting indicator using a thin tipped marker and record this volume in the Calibration Log book.

3.11 Manufacturer Service Contracts

IATL has our AAS instrument under a service agreement contract (see attached) with the manufacturer. The agreement calls for unlimited emergency calls. Usual response time is within 24 hours. A copy of this agreement is located in the Laboratory Director's file top draw under PE Current. Phone numbers of the PE technician are posted in the AAS Room.

3.12 Software Validation

IATL uses spreadsheet software to do calculations for QA/QC samples, Sample results, MDL analysis, and QC control charting. Prior to the implementation of any software-generated results, calculations are validated manually to ensure correct scripting. Once validated spreadsheet cells containing calculations are protected by a setting available through the application itself. This setting blocks specified cells from user alterations of any kind.

4.0 Standards Preparation / Instrument Calibration

Standards preparation and instrument calibration are of utmost importance for metals and environmental lead sample analyses. Strict control and documentation of calibration standards and reagents are maintained. This section of the SOPs and QA Manual will discuss the various types of standards, why and how they are utilized, and the criteria IATL uses to judge the effectiveness of these tools.

Note: All standards & reagents must be labeled with a received date, received by, expiration date, and a date when opened. Reagent log book must also reflect this information. The expiration date is signified in the log book by a circled date.

4.1 Definitions of Standards

NIST Traceable Standard - National Institute of Standards and Technology (NIST) prepares a variety of Standard Reference Materials (SRMs). These reference materials are rigorously characterized and analyzed by definitive methods. They are expensive and not intended to be used for routine quality control. They are intended for the development and validation of methods and as a real-world tool to evaluate method performance. Examples of NIST SRMs available for Pb-based matrices are listed below. IATL utilizes several of these SRMs. Certificates of analysis for each is maintained in a notebook in the Technical Library.

SRM	Description and Date	Certified Lead (Pb)
2581	Powdered based paint	0.449% \pm 0.011%
2587	Trace Lead in Soil	3242 mg / Kg \pm 57
2589	Powdered paint	9.99% \pm 0.16%
2704	Buffalo River Sediment, 1990	161 μ g/g \pm 17
2709	Baseline agric. soil, 1992	18.9 μ g/g \pm 0.5
2711	Moderately contam. soil, 92	1162 μ g/g \pm 31

Reference Materials - Other non-NIST standards are available. Though well defined by NYSDOH and AIHA proficiency testing they are not officially certified. They may be used for internal quality control samples with a high level of confidence. These older PT samples must have published results and acceptable ranges prior to their employment.

Primary Standard - These are solutions of standards that have been prepared directly from an NIST traceable standard by serial dilution. These are certified prior to purchase to be used for instrument calibration standards, calibration verification standards and for spiking. The preparation of these standards follows in Section 4.3. Matrix based SRMs are not primary standards and are not suitable for instrument calibration.

Stock Solution and Working Standards - Stock primary standards must be prepared from material traceable to NIST. Acids used in the standards should match those used in the matrix preparation. Purchased stock standards should include certificates showing NIST traceability. Stock solutions are not to be used beyond the date of expiration printed on the label. Solutions out of date are to be disposed of as hazardous waste.

Laboratory Control Sample (LCS) - A matrix-based reference material with an established concentration obtained from a source independent of the instrument calibration and traceable to NIST or other reference materials. The LCS is carried through the entire procedure from digestion through analysis as a field sample. The purpose of the LCS is to evaluate bias of the method.

Secondary Standard - This standard is prepared by direct serial dilution from a certified stock solution.

Initial Calibration Verification Standard (ICV) - A set of solutions used to verify the calibration curve at numerous points. The standards are made from stock solutions having a different manufacturer or manufacturer lot identification than the calibration standards. The ICVs are prepared in the same acid matrix as the calibration standards. The concentration can be other than that used for instrument calibration, but within the calibration range (Upper and lower ends and near mid-range of curve).

Continuing Calibration Verification Standard (CCV) - To ensure accuracy during each analysis run by verifying the working calibration curve, a common CCV standard is analyzed at a frequency of one per 20 samples or every two hours during an analysis run, whichever is more frequent. The CCV standard is also run at the beginning of the run and after the last analytical sample. The CCV may be an outside standard or a laboratory-prepared standard traceable to EPA or NIST materials, and is prepared at a concentration corresponding to levels of concern for analyzed samples.

Initial Calibration Blanks (ICB) and Continuing Calibration Blanks (CCB) - The initial calibration blank and the continuing calibration blank are used to ensure that the baseline remains at zero. Blanks contain only acids and deionized water, and are prepared in the same manner as calibration standards. The ICB is run each time the instrument is calibrated, and the CCB is run immediately after each CCV sample. The absolute value of the blanks should be less than or equal to the minimum level of detection. If the ICB/CCB falls out of acceptability corrective action must be taken. If steps other than purging are required all initial check standards must be rerun to verify calibration.

Field Blanks - Field blanks are analyzed with the field samples to determine accidental or incidental contamination in the sample during collection process. The field blanks are taken to the field simply for exposure to normal sampling conditions. The field blanks are returned to the laboratory with the other field samples and are treated as analytical samples.

Preparation Blanks or reagent blanks - Preparation blanks, also known as reagent blanks, are used to estimate possible contamination within a batch of digested samples. The contamination can be the result of varying amounts of the sample processing acids. The preparation blanks must contain the same acid concentrations and volumes of reagents as that in the preparation and processing of the field samples. The absolute value of the Pb should be less than or equal to the minimum level of detection. If not, any samples associated with this blank having concentrations below ten times the blank concentration and above the minimum detection limit must be redigested and reanalyzed.

SEE ALSO CHART 4: SUMMARY OF STANDARDS

4.2 Calibration / Verification Standards

Five calibration standards will be prepared on an as needed basis for flame analysis (four standards for furnace). An additional four standards will be prepared from a second supplier or lot in order to verify the calibration (three standards for furnace). Since the analytical technique is designed to identify analytes that have near threshold concentrations (i.e. lead paint at 0.5% Pb), check standards will be analyzed at these levels.

4.2 Calibration / Verification Standards (continued)

The calibration curve shall not go beyond twice the value of the maximum linear range. For Flame AA a non-linear calibration method is used. A linear regression calculation is performed to ensure a minimum correlation coefficient of 0.998. This calibration is further verified by check standards at 4 points along the curve, three of which are held to a tolerance of +/- 5%.

The standards will be labeled by their lead concentrations as follows:

ICV/CCV =	2.5 mg/L	Check
0.2 ppm =	0.2 mg/L	Check
0.2 ppm =	0.2 mg/L	Calibration
0.5 ppm =	0.5 mg/L	Calibration
5.0 ppm =	5.0 mg/L	Calibration
10 ppm =	10.0 mg/L	Check
20 ppm =	20.0 mg/L	Calibration
40 ppm =	40.0 mg/L	Calibration
40 ppm =	40.0 mg/L	Check

Any samples that have concentrations greater than the highest calibration standard must be serially diluted and reanalyzed until the measured concentration falls within the range bracketed by the standards. The analyst must notate the dilution and include the factor in calculating the results.

4.3 Standard Preparation

4.3.1 Standards Log - All standard preparations will be logged in the Standards Log book. This will include the analyst initials, date, supplier, lot number, expiration date (45days), and analytical run number of first use. This will also be noted in the Instrument Log Book on the first day of use. The calibration standards for graphite furnace must be made fresh on the day of analysis.

4.3.2 Aliquot Accuracy - All measurements of less than 10 ml will be done with Thermo Labsystem's Finn pipettes. These instruments are to be verified for the volume selected prior to use. Adjustments should be made using the tool provided by the manufacturer to achieve an accuracy of +/- 1%. Verification is to be recorded in the Pipette Calibration Log as an average of 5 aliquots.

4.3.3 Preparation Series: Stock Solution - Two stock solutions of differing origin or lot number will be purchased for each analyte and must include a certificate of analysis showing NIST traceability. One solution is to be used solely for the preparation of calibration standards and the second for spiking and verification standards.

4.3.4. Preparation Series: Calibration and Verification Standards - Primary standards will be prepared according to the following table by adding and mixing the indicated reagents in the specified clean volumetric flask, and diluting to volume.

- 4.3.4.1. Verify Finn pipette for each volume dispensed.
 - 4.3.4.2. Using a clean, acid rinsed class A volumetric flask fill $\frac{3}{4}$ with Deionized water. Add appropriate volume of HNO_3 (Note reagent grade!)
 - 4.3.4.3. Use finnpipette to dispense the appropriate volume(s) of stock solution(s)
 - 4.3.4.4. Carefully bring to volume using Deionized water bottle. (The bottom of the meniscus should be at line of demarcation.)
 - 4.3.4.5. Seal tightly with parafilm and mix by inversion (4 times minimally).
 - 4.3.4.6. Transfer to clean, labeled, polyethylene bottle and note in the AAS Standards Log.
- Secondary standards will be prepared according to the following table:

Table 4.3

Standard Name / Concentration	Aliquot Vol. (mL)	Stock Standard Conc. (mg/L)	Final Vol. (mL)	Final Conc. (mg/L)	Volume of HNO ₃ (mL)	Supplier (C/V)*
RL – 0.2 ppm	0.020	1000	100	0.2	10	V
0.2 ppm	0.020	1000	100	0.2	10	C
0.5 ppm	0.050	1000	100	0.5	10	C
ICV/CCV 2.5 ppm	1.25	1000	500	2.5	50	V
5.0 ppm	0.50	1000	100	5.0	10	C
10.0 ppm	1.0	1000	100	10.0	10	V
20.0 ppm	2.0	1000	100	20.0	10	C
40.0 ppm	4.0	1000	100	40.0	10	C
40.0 ppm	4.0	1000	100	40.0	10	V
2.0 ppb	0.020	10	100	0.002	0.5	V
5.0 ppb	0.050	10	100	0.005	0.5	C
10 ppb	0.10	10	100	0.010	0.5	C
20 ppb	0.20	10	100	0.020	0.5	C
40 ppb	0.40	10	100	0.040	0.5	C
ICV/CCV 15 ppb	0.15	10	100	0.015	0.5	V
40 ppb	0.40	10	100	0.040	0.5	V

* C- calibration standard (Ultra Scientific) , V- verification standard (VWR)

4.4 Calibration Curve

Both flame and furnace AAS require instrument calibration in order to relate instrument response to sample analyte levels. A calibration curve is required for this purpose. A calibration curve is the graphical representation between the known values for a series of calibration standards and instrument responses.

For the analysis by flame, five calibration standards are used. The instrument determines automatically the best calibration method. This is generally a two-coefficient curve with a correlation coefficient of 1.000. The linearity of this curve is confirmed by means of linear regression to have a correlation coefficient not less than 0.998. Following calibration verification standards are analyzed to confirm the accuracy of the curve to within + or – 5% at three points along the curve and at + or – 20% at the Reporting level. See table 4.3 for all calibration and verification standard concentrations.

For the analysis by graphite furnace, four calibration standards are used. A linear calibration method is used with a minimum correlation coefficient of 0.998. Following the calibration, verification standards are analyzed to confirm the accuracy of the curve to within + or – 10% at two points along the curve and at + or – 20% at the Reporting level. See table 4.3 for all calibration and verification standard concentrations.

Any samples that have concentrations greater than the highest standard in use must be serially diluted and reanalyzed until the measured concentration falls within the range bracketed by the standards. The analyst must note dilution in run and include this factor in result calculation.

NOTES ON INSTRUMENT ANALYSIS FOUND IN SECTION 6

On a daily basis the analyst is to initiate all instrument set-up procedures (see Sec. 6) and run a calibration curve. This curve, once acquired, must meet certain criteria described in Sec 4.5 and then be printed-out and the hardcopy with date be included with that day's analytical QC file.

4.5 Acceptance / Rejection Criteria

There are several factors influencing the quality of the calibration curve. These include subtle instrument variables and room conditions. Most often problems associated with standards preparation are the main culprit. In order to have a valid run the following criteria must be achieved. If these criteria are not met then the appropriate corrective actions must be taken and instrument set-up must be re-initiated. If the criteria are still not met, than the manufacturer's technical service representative must be called to correct any instrument problems.

The circumstances requiring corrective action are:

- 4.5.1. The calibration curve correlation coefficient is less than 0.998.
- 4.5.2. Initial Calibration Verification standards exceed +/- 5% (+/- 20% for RL level standard)
- 4.5.3. Any blank exceeds 0.1mg/l by flame AAS,
- 4.5.4. Spike/LCS recoveries fall outside of the upper and lower acceptance criteria established from the Spike QC for the previous year (posted in AAS room).
- 4.5.5. Instrument maintenance is required or aspirator becomes clogged.

In all cases of QC run rejection, the analyst, QA Coordinator, and Laboratory Director must be informed and the reason(s) noted in the daily run.

4.6 Reagents

Regardless of the quality of reagents, water, and modifiers, there may be some contamination of the analytical process. IATL uses several means of preventing and controlling potential contamination throughout the laboratory. Below we summarize the controls for reagent contamination. For other contamination controls see Section 6, 7, and 10 of the SOP and QA Manual.

All standard preparations will be logged in the Standards Log. This document indicates details related to standards preparation: date of preparation, who prepared them, what traceable standard was utilized, the quantity of traceable standard used, the final volume, acid concentration, the run number of its initial use and an expiration date.

The reagents used at IATL for the purpose of metals and environmental lead analysis are manufacturer assayed to be less than 0.5ppb or 0.05ppm of any target analyte depending on the method employed. This includes VWR, Fisher, and Mallinckrodt brands. The labels are checked and dated for expiration when received by the laboratory. Usually IATL will have an operating 2.5L container fitted with a re-pipetter. When a new case of 2.5L HNO₃ bottles arrive, several new reagent blanks (see below) are prepared before any individual bottle is utilized as the prep run acid distribution bottle.

A Digestion blank or Reagent blank is a mixture of all reagents used for the digestion of paint, soil, or dust wipes matrices but without any matrix material. This blank is carried through all steps of the analysis starting with the digestion step. This blank evaluates the process for contamination from the laboratory. Data for this sample is included on the cover sheet for each day's analytical run.

If this blank shows more than 0.2 mg/L of target analyte by flame AAS or 0.4 mg/ml by furnace, than the analytical run may be rejected. See also Section 4.5

5.0 Sample Preparation

This section of the QA Manual/SOP is available to all levels of analysts in the AAS Room and Technical Library. Sample preparation procedures are dependent on many factors. There are different procedures depending on matrix material, instrument set-up, analytical sensitivity requirements, and client requests. Each sample preparation SOP is also separate so that amendments and updates may be completed without effecting all the methods listed. *IATL uses only methods mandated by legal requirements, recognized published methods, or methods developed and validated by the laboratory.* Revision of analytical procedures employed at IATL follows a four step process SEE SEC 5.8.

Methods are not used for reporting analyses until competence for each particular matrix is demonstrated by the laboratory through in-house and outside proficiency testing.

Scope: There are several general considerations that must be discussed before the method can be effectively employed. Of these, only preparation considerations will be discussed in this section. Related topics (i.e. instrument set-up, calculations, etc.) are discussed elsewhere.

Field Sampling: IATL performs no field sampling but promotes good practices in the field by educating clients with free materials and copies of methods etc. (see Sec. 3.5.1) IATL also trains its technicians to recognize that sampling can effect laboratory results in both positive and negative ways depending on homogeneity, sample size, materials used, and associated materials not separable from the sample.

5.1 Sample Matrix Preparation: Paint

There are several procedures established in the literature for the preparation of paint for analysis of lead by atomic absorption spectrophotometry. IATL uses a method based upon [ASTM D3335-85a](#). Following extensive in-house testing and ELPAT testing the method below has been adopted for use on all paint samples submitted.

Interferences:

ASTM D3335-85a does not include a section regarding Interferences. Section 1.3 states;

“This test method is not applicable to the determination of lead in sample containing antimony pigments (low recoveries are obtained).

Samples will be prepared in batches of twenty samples. Each batch is to include a method blank, LCS, sample duplicate, and sample spike.

A) Enter Client name/abbreviation into the margin of the ‘AAS Data Worksheet – LBP’ spreadsheet page. Enter the first IATL sample number on the adjacent column. By default the first sample will be used for Duplicate and Sample Spike QC. The eleventh will be used as a second duplicate by default. Print pages when complete.

B) Label 50 ml centrifuge tubes in the order that they appear on AAS Worksheets.

C) Weigh out samples using 100 to 300 mg portions directly into centrifuge tubes.

Record sample weights in milligrams using four significant figures.

Annotations should be made under the comments section to note matrix peculiarities, sample deficiencies, or other relevant comments.

(ex; * - Insufficient sample)

D) Transfer tube to white test tube rack. Centrifuge caps for each sample are to be placed on a pre-folded, labeled paper towel in the same order as the samples in the rack.

(Racks and cap trays are labeled with a letter for association of caps with their respective tube).

E) Include method blank (MB), laboratory control standard (LCS), matrix spikes (S) and duplicates (D) at 5% (1/20 samples) and for any non-filled batch.

Note that by using the same sample for both the Sample Spike and the Sample Duplicate, all results are more thoroughly verified. QC Samples are spiked using 500 µL of 1000 ppm lead standard. The sample number followed by “D” or “S” as appropriate designates duplicates and spikes.

F) After all samples are weighed out use the auto-repipetter to add 5 mL of AR grade concentrated nitric acid under the fume hood.

G) Place rack in the pre-heated hot water bath (@ 95° C).

H) Cook samples for 90 minutes.

I) Remove from water bath and allow to cool.

5.6 Sample Matrix Preparation: Paint (continued.)

- J) Bring to a final volume of 50 mL by adding 45 mL of De-Ionized water using the 50 mL repipetter.
- K) Wipe tube threads of any liquid and cap tubes.
- L) Using paper towels, dry tubes while firmly closing.
- M) Transfer to Styrofoam racks and invert several times to mix.
- N) Centrifuge for 5 minutes at approximately 3000 rpm.

5.2 Sample Matrix Preparation: Air

There are several procedures established in the literature for the preparation of air emission and air monitoring samples for the analysis of lead by atomic absorption spectrophotometry. IATL uses a method based upon [NIOSH 7082](#). In the case of TSP/PM10 air filter submissions the EPA 40CFR Appendix G (TSP/PM10) method is the basis for our method. Following extensive in-house testing and PAT testing the method below has been adopted for use on all non-TSP air samples submitted.

INTERFERENCES: Use D₂ or H₂ continuum or Zeeman background correction to control flame or molecular absorption. High concentrations of calcium, sulfate, carbonate, phosphate, iodide, fluoride, or acetate can be corrected.

Samples will be prepared in batches of twenty. Each batch is to include a matrix blank, LCS, matrix spike, and matrix spike duplicate.

- A) Enter Client name/abbreviation into the margin of the 'AAS Data Worksheet – Air' spreadsheet page. Enter the first IATL sample number on the adjacent column.
- B) Under the comments section, column N, enter the sample volume in liters as supplied by the client. For field blanks type "FB" in column M. Any comment annotations should be entered under column N.
- C) Label clean dry 20mL disposable culture tubes for all samples and appropriate QC (i.e. matrix blank, LCS, matrix spike, and matrix spike duplicate.) and place in white racks. Damaged or dirty tubes should be properly discarded.
- D) Spike QC accordingly:
 - Matrix spikes (MS) using 50µL of 1000 ppm Pb
 - LCS using ~15.6 mg of soil SRM 2587
- E) Damaged filters are to be noted and voided. (See Laboratory Director)
- F) Incorrect membrane filters or cassette types must be noted and a Sample Management Report must be completed.
- G) Break the seal of the air cassette using the bottom of the modified scalpel handle. Press the sharpened edge of the handle against the seal at the point where the base of the cassette meets the top portion of the cassette. This groove can be used to guide the handle while turning the cassette until the seal is completely separated.
- H) Next use the handle to pry the cassette apart.
- I) Using the dental pick the filter and pad can be raised to a point where they can be separated without losing any loose material on the filter.
- J) If excessive amounts of material are present it should be poured into the tube first. Then the filter can be folded and dropped into the appropriate tube.
- K) Complete these steps for all samples and wipe bench-top using a Kimwipe. Introduce this as a contamination check sample.

- L) Adjust the auto-repипetter to dispense 1.5 mL of AR grade concentrated Nitric Acid. (Pipetter is appropriately marked)
- M) Under the fume hood add 1.5 mL of concentrated Nitric Acid to each of the culture tubes.
(Samples with high levels of debris may require more acid, make 1.5 mL additions as needed)
- N) Place rack in pre-heated hot water bath, @ 95° C, and digest for 60 minutes.
- O) Allow to cool and bring to a final volume of 10 mL by adding 8.5 mL of De-Ionized water using the 50 mL repипetter.
- P) Allow more time to cool and mix by inversion.

5.3 Sample Matrix Preparation: Dust Wipe

There are several procedures established in the literature for the preparation of dust wipes for analysis of lead by atomic absorption spectrophotometry. IATL uses a method based upon [EPA SW846 3050](#). Following extensive in-house testing and ELPAT testing the method below has been adopted for use on all paint samples submitted. Until more computers become available some information will be hand written on forms before being entered into the AAS Data Worksheet spreadsheets. Thus in the future analysts will be expected to enter all data directly into the computer unless otherwise prohibited.

Interferences: See section 3.0 of the EPA SW846 7000a for a full explanation of the inferences involved in this analysis method.

The sample preparation method for all wipe materials is almost exactly the same. Under the EPA 403 Final Rule (40 CFR 745.63) only wipes meeting ASTM E1792 are considered acceptable materials. Results for wipes not meeting ASTM E1792 are not recognized within this Accreditation Program. Clients using unacceptable materials must be notified by way of remarks included with preliminary results and a copy of the notice excerpt. (See attached following Section 5.8)

Samples will be prepared in batches of twenty. Each batch is to include a matrix blank, LCS, and LCS duplicate.

- A) Enter Client name/abbreviation into the margin of the 'AAS Data Worksheet – Wipe' spreadsheet page. Enter the first IATL sample number on the adjacent column.

Take note of the type of wipe material submitted and separate materials by digestive properties. (i.e.; Ghost wipes – 4mL of HNO₃, Pace/Palintest wipes – 8 mL of HNO₃, and larger materials – 15 to 20 mL of HNO₃)

- B) Under the comments section, column N, enter the sampling area in square feet as supplied by the client. For field blanks type "FB" in column M. Any comment annotations should be entered under column N.

- C) Label 50 ml centrifuge tubes in the order that they appear on AAS Worksheets.

- D) Transfer tube to white test tube rack. Centrifuge caps for each sample are to be placed on a pre-folded, labeled cardboard tray in the same order as the samples in the rack.

(Racks and cardboard trays are labeled with a letter for association of caps with their respective tube).

- E) Transfer samples and any debris directly into centrifuge tubes.

Drying samples prior to digestion is preferred for all wipe materials.

Annotations should be made under the comments section to note the absence of field blanks, sampling areas, or other relevant comments.

- F) Spike QC accordingly:

LCS and LSCD (WS & WSD) spiked using NIST Traceable reference materials in a matrix matching that of the samples submitted.

- G) After all samples are transferred use the spatula to push the wipe material to the bottom of the tube. Then place the racks on the water bath under the hood.

Note that Ghost Wipes react violently and must be treated under the enclosed hood. Wipes should not be packed down at the bottom of the tube.

- H) Using AR grade concentrated Nitric Acid pipette 2 ml of acid into each tube in a controlled manner. Given sufficient time to react pipette acid again to the appropriate volume.

Note; Ghost wipes are less likely to overflow with this initial volume. Second addition of acid may be greater than 2 ml depending on the wipe material being treated.

- I) Place rack in the pre-heated hot water bath (@ 95° C).
J) Cook samples for 60 to 90 minutes.
K) Remove from water bath and allow cooling.
L) Bring to a final volume of 50 mL by adding appropriate volume of De-Ionized water using the 50 mL repipetter.
M) Wipe tube threads of any liquid and cap tubes.
N) Using paper towels, dry tubes while firmly closing.
O) Transfer to Styrofoam racks and invert several times to mix.
P) Centrifuge for 5 minutes at approximately 3000 rpm.

5.4 Sample Matrix Preparation: Soil

There are several procedures established in the literature for the preparation of soil for analysis of lead by atomic absorption spectrophotometry. IATL uses a method based upon [EPA SW846 3050](#). Following extensive in-house testing and ELPAT testing the method below has been adopted for use on all soil samples submitted. Until more computers become available some information will be hand written on forms before being entered into the AAS Data Worksheet spreadsheets. Thus in the future analysts will be expected to enter all data directly into the computer unless otherwise prohibited.

Interferences: See section 3.0 of the EPA SW846 3050b for a full explanation of the interferences involved in this analysis method.

Samples will be prepared in batches of twenty samples. Each batch is to include a method blank, LCS, sample duplicate, and sample spike.

- A) Enter Client name/abbreviation into the margin of the 'AAS Data Worksheet – Soil' spreadsheet page. Enter the first IATL sample number on the adjacent column. By default the first sample will be used for Duplicate and Sample Spike QC. The eleventh will be used as a second duplicate by default. Print pages when complete.
- B) Label 50 ml centrifuge tubes in the order that they appear on AAS Worksheets.
- C) Weigh out samples using 1000 to 3000 mg portions directly into centrifuge tubes.
Record sample weights in milligrams using four significant figures.
Annotations should be made under the comments section to note matrix peculiarities, sample deficiencies, or other relevant comments.(ex; DW- Results based on dry weights)
- D) Transfer tube to white test tube rack. Centrifuge caps for each sample are to be placed on a pre-folded, labeled paper towel in the same order as the samples in the rack.
(Racks and cap trays are labeled with a letter for association of caps with their respective tube).
- E) Include method blank (MB), laboratory control standard (LCS), matrix spikes (S) and duplicates (D) at 5% (1/20 samples) and for any non-filled batch.
Note that by using the same sample for both the Sample Spike and the Sample Duplicate, all results are more thoroughly verified. QC Samples are spiked using 500 µL of 1000 ppm lead standard. The sample number followed by "D" or "S" as appropriate designates duplicates and spikes.
- F) After all samples are weighed out use the auto-repипetter to add 5 mL of AR grade concentrated nitric acid under the fume hood.
- G) Place rack in the pre-heated hot water bath (@ 95° C).
- H) Cook samples for 90 minutes.
- I) Remove from water bath and allow to cool.

- J) Bring to a final volume of 50 mL by adding 45 mL of De-Ionized water using the 50 mL repipetter.
- K) Wipe tube threads of any liquid and cap tubes.
- L) Using paper towels, dry tubes while firmly closing.
- M) Transfer to Styrofoam racks and invert several times to mix.
- N) Centrifuge for 5 minutes at approximately 3000 rpm.

5.5 Sample Matrix Preparation: Water

There are several procedures that are established in the literature for the preparation and analysis of lead in drinking water samples by atomic absorption spectrophotometry (AAS-furnace). These methods are discussed below. Unless specified by the client or a minimum detection limit requirement, IATL uses a method based upon method [ASTM 3559-03\(D\)](#) all environmental lead in potable water samples.

Interferences: See section 9.1 of ASTM Method D3559-03(D)

Scope: There are several general considerations that must be discussed before the method can be effectively employed. Of these, only preparation considerations will be discussed elsewhere.

Field Sampling: IATL performs no field sampling, but as this is an important, sometimes limiting, step IATL promotes good practices in the field by educating clients with free materials and copies of methods etc. (see Sec. 3.5.1) IATL also trains its technicians to recognize that sampling will effect laboratory results. IATL technicians have a thorough understanding of field sampling and its relationship to the non-uniformity of some samples, associated materials that may interfere with the homogeneity of a matrix, and the effects of minimum sample sizes. The HUD guidelines and EPA40CFR methods have protocols for this sampling. The collection should detail location, times, flush versus draw, etc. Proper sample containers and preservative may be required.

Sample Containers / Volume: The HUD-EPA guidelines provide adequate sampling protocol. The laboratory must be aware, notate the presence of, and be able to communicate to the client when samples are received that contain too little sample size (see below) and have associated debris present. Only sterile re-sealable containers over 50 mL volumes can be accepted. IATL will add preservative if samples have not been acidified. The minimum sample size collected is based upon the ability to detect a metal at the action level recommended in various guidelines with a defined degree of confidence.

Sample Preservation: Upon receipt in the laboratory trace metal grade nitric acid is added to preserve the sample at < 2.0 pH. All unpreserved samples will be treated with 500 µL of acid per 100ml of sample.

Potability: Sample turbidity, pH, color, and odor will be tested for applicability to the National Primary Safe Drinking Water regulations. Only those samples less than 1.0 NTU are considered potable. If the sample is < 1.0 NTU then no sample preparation is required. An aliquot may be directly added to the furnace AAS auto sampler. If the NTU is > 1.0 then digestion must be performed.

Potable QC: Although digestion is not required Quality checks are. At the beginning of each run an LCS, Matrix Blank, and Matrix Spike are to be analyzed. Sample Spikes and Sample Duplicates are also required. One Duplicate per batch of 20 samples is required. One Sample or Post Spike is required per client project or water supply source.

LCS - 50 mL DI water acidified to 0.5% HNO₃ and spiked w/ 100 µL of 10 ppm Pb

Matrix Blank - 50 mL tap water source acidified to 0.5% HNO₃.

Matrix Spike - 50 mL tap water source acidified to 0.5% HNO₃ and spiked w/ 100 µL of 10 ppm Pb

Sample Spike – 50 mL of preserved sample spiked w/ 100 µL of 10 ppm Pb (adjust spike level accordingly if less than 50 mL available for spiking).

5.5.1 Method: IATL modified method ASTM 3559-03(D)

A copy of this method is available in the IATL technical library. The Laboratory Training Program (LTP) requires that the technician read this method. All personal protective equipment (PPE) must be worn when in the CHEM Prep Room and when manipulating samples. (Section 3.2) A summary of the method as employed by IATL follows:

- A) Fill out the 'Non-potable Water Prep Log' including IATL sample numbers and QC samples.
- B) Prior to preparation wash and nitric acid rinse all necessary glassware (i.e.: graduated cylinders)
- C) Label 50 mL centrifuge tubes for all samples and QC and place in test tube rack.

Note that QC consists of a Prep Blank, LCS, Matrix Spikes (5%), and Matrix Duplicates (5%).

LCS and Matrix Spikes spiked with 50µL of 10 ppm Pb.

(Where sample volumes are limited prepare a duplicate LCS in lieu of Matrix Dup and Matrix Spike.)

- D) Add 1.0 mL of high purity grade Nitric Acid to each centrifuge tube.
- E) Pour 50 mL of well-mixed sample into appropriate centrifuge tube.
- F) Heat samples at 95 degrees Celsius in a hot water bath in a well ventilated fume hood until the volume has been reduced to 7.5 to 10 mL. Do not allow samples to boil.
- G) Bring to a final volume of 50 mL using DI water.
- H) Using paper towels, dry tubes while firmly closing.
- I) Transfer tubes to Styrofoam racks and mix by inversion.
- J) Centrifuge samples for 5 min at 3000 rpm if needed.

5.6 Sample Matrix Preparation: Consumer Products (Non-Porous)

There are several procedures established in the literature for the preparation of testing lead in consumer products (ex. paints, pigments, vinyl materials, etc.) by atomic absorption spectrophotometry. IATL uses a method based upon [EPA SW846 3050](#). Following extensive in-house testing and ELPAT testing the method below has been adopted for use on all product samples submitted. Until more computers become available some information will be hand written on forms before being entered into the AAS Data Worksheet spreadsheets. Thus in the future analysts will be expected to enter all data directly into the computer unless otherwise prohibited.

Interferences: See section 3.0 of the EPA SW846 3050b for a full explanation of the inferences involved in this analysis method.

Samples will be prepared in batches of twenty samples. Each batch is to include a method blank, LCS, sample duplicate, and sample spike.

- A. Enter Client name/abbreviation into the margin of the 'AAS Data Worksheet – Soil' spreadsheet page. Enter the first IATL sample number on the adjacent column. By default the first sample will be used for Duplicate and Sample Spike QC. Print pages when complete.
- B. Label 50 ml centrifuge tubes in the order that they appear on AAS Worksheets.
- C. Weigh out sample using 100 to 1000 mg portions directly into centrifuge tubes, cutting the sample if necessary.

Each sample should be of like pigments if possible.

Record sample weights in milligrams using four significant figures.

Annotations should be made under the comments section to note matrix peculiarities, sample deficiencies, or other relevant comments.(ex; DW- Results based on dry weights)

For composite samples, remove all similar materials from sample in appropriate portions and designate a letter to each material (ex; 321456A, 321456B, etc.)

- D. Transfer tube to white test tube rack. Centrifuge caps for each sample are to be placed on a pre-folded, labeled paper towel in the same order as the samples in the rack.

(Racks and cap trays are labeled with a letter for association of caps with their respective tube).

- E. Include method blank (MB), laboratory control standard (LCS), matrix spikes (S) and duplicates (D) at 5% (1/20 samples) and for any non-filled batch.

Note that by using the same sample for both the Sample Spike and the Sample Duplicate, all results are more thoroughly verified. QC Samples are spiked using 500 µL of 1000 ppm lead standard. The sample number followed by "D" or "S" as appropriate designates duplicates and spikes.

- F. After all samples are weighed out use the auto-repipetter to add 5 mL of AR grade concentrated nitric acid under the fume hood.
- G. Place rack in the pre-heated hot water bath (@ 95° C).

- H. Cook samples for 90 minutes.
- I. Remove from water bath and allow cooling.
- J. Bring to a final volume of 50 mL by adding 45 mL of De-Ionized water using the 50 mL repipetter.
- K. Wipe tube threads of any liquid and cap tubes.
- L. Using paper towels, dry tubes while firmly closing.
- M. Transfer to Styrofoam racks and invert several times to mix.
- A) Centrifuge for 5 minutes at approximately 3000 rpm.

5.7 Sample Matrix Preparation: Consumer Products (Porous)

There are several procedures established in the literature for the preparation of materials for analysis of lead by atomic absorption spectrophotometry. IATL uses a method based upon [EPA SW846 3050](#). Following extensive in-house testing and ELPAT testing the method below has been adopted for use on all soil samples submitted. Until more computers become available some information will be hand written on forms before being entered into the AAS Data Worksheet spreadsheets. Thus in the future analysts will be expected to enter all data directly into the computer unless otherwise prohibited.

Interferences: See section 3.0 of the EPA SW846 3050b for a full explanation of the inferences involved in this analysis method.

Samples will be prepared in batches of twenty samples. Each batch is to include a method blank, LCS, sample duplicate, and sample spike.

- A) Enter Client name/abbreviation into the margin of the 'AAS Data Worksheet – Soil' spreadsheet page. Enter the first IATL sample number on the adjacent column. By default the first sample will be used for Duplicate and Sample Spike QC. Label 50 ml centrifuge tubes in the order that they appear on AAS Worksheets.
- B) Weigh out sample using 100 to 1000 mg portions directly into centrifuge tubes, cutting the sample if necessary.
 - Each sample should be of like pigments if possible.
 - Record sample weights in milligrams using four significant figures.
 - Annotations should be made under the comments section to note matrix peculiarities, sample deficiencies, or other relevant comments.(ex; DW- Results based on dry weights)
- C) Transfer tube to white test tube rack. Centrifuge caps for each sample are to be placed on a pre-folded, labeled paper towel in the same order as the samples in the rack.
 - (Racks and cap trays are labeled with a letter for association of caps with their respective tube).*
- D) Include method blank (MB), laboratory control standard (LCS), matrix spikes (S) and duplicates (D) at 5% (1/20 samples) and for any non-filled batch.

Note that by using the same sample for both the Sample Spike and the Sample Duplicate, all results are more thoroughly verified. QC Samples are spiked using 500 µL of 1000 ppm lead standard. The sample number followed by “D” or “S” as appropriate designates duplicates and spikes.

- E) After all samples are weighed out use the auto-repипetter to add 5 mL of AR grade concentrated nitric acid under the fume hood.
- F) Place rack in the pre-heated hot water bath (@ 95° C).
- G) Cook samples for 90 minutes.
- H) Remove from water bath and allow to cool.
- I) Bring to a final volume of 50 mL by adding 45 mL of De-Ionized water using the 50 mL repипetter.
- J) Wipe tube threads of any liquid and cap tubes.
- K) Using paper towels, dry tubes while firmly closing.
- L) Transfer to Styrofoam racks and invert several times to mix.
- M) Centrifuge for 5 minutes at approximately 3000 rpm.

5.8. Sample Matrix Preparation: TCLP

There is one procedure established in the literature for the Toxicity Characteristic Leaching Procedure for the testing lead in consumer products (ex. paints, pigments, vinyl materials, etc.) by atomic absorption spectrophotometry. IATL uses a method based upon [EPA 1311 TCLP](#). Following extensive in-house testing and ELPAT testing the method below has been adopted for use on all samples submitted.

Interferences: See section 3.0 of the EPA SW846 3050b for a full explanation of the interferences involved in this analysis method.

Samples will be prepared in batches of twenty samples. Each batch is to include a method blank, LCS, sample duplicate, and sample spike.

- A) All of the following steps must be performed while wearing protective clothing. This includes safety glasses, lab coat, and latex gloves.
- B) A representative subsample is to be taken from the original sample. It is to be at least 110 grams.
- C) This subsample is to then be examined to ensure that it is 100 percent solids.
- D) The subsample must then be ground up/crushed (if necessary) to a size <9.5mm
- E) A small amount is to then be taken in order to test its pH. This must be done to know which extraction fluid must be used (see section Extraction Fluid Prep).
 - 1. First, weigh out 5 grams. Then further reduce the particle size using the mill to approx. 1mm. or less.
 - 2. Next, transfer this to a 250ml Erlenmeyer flask and add 96.5ml of DI water to the flask.
 - 3. Cover with a parafilm and stir for 5 minutes with a magnetic stirrer. Calibrate the pH meter. Record the pH.
 - 4. If the pH is <5.0, use extraction fluid #1.

5. If the pH is >5.0 , add 3.5ml 1N HCl. Mix briefly, cover with parafilm, heat to 50C and hold at 50C for 10 minutes.
6. Let the solution cool to room temp and record the pH. If pH is <5.0 use extraction fluid #1. If the pH is >5.0 use extraction fluid #2.
- F) After the correct extraction fluid has been determined, place the remaining ~100g of subsample into the extraction vessel.
- G) Add in the appropriate amount of extraction fluid to the extraction vessel. 20x the weight of the sample is to be used.
- H) Tightly close the vessel and rotate at 30 RPM for 18 hours at room temperature.
 1. During the first 10, 20, and 30 minutes, open the vessel under a fume hood to vent any gases that have built up. Continue to vent gases at approximately 1, 2, and 3 hours after tumbling has started.
- I) After the 18 hour extraction, the material in the vessel must be separated into it's component liquid and solid phases. This is done by filtering through a glass fiber filter.
 1. First, place a clean, newly labeled extraction vessel under the filter apparatus. Then transfer/pour the material in the extraction vessel into the filter apparatus. Connect the air line to the filter apparatus.
 2. Gradually apply pressure of 1-10 psi until air moves through the filter. If no air moves through the filter AND no additional liquid has passed through the filter in any 2 minute interval, then slowly increase the pressure in 10 psi increments up to a maximum of 50 psi.
 3. After each 10 psi increase, if no air passes through the filter and no additional liquid has passed through in any 2 minute interval, then proceed to the next psi level.
 4. When the air begins to move through the filter or the liquid flow has ceased at 50 psi, stop the filtration.
- J). The solid material remaining in the filter apparatus should be discarded in a Ziploc bag. The filter apparatus should then be thoroughly cleaned and then rinsed with DI water.
- K). The liquid obtained in this separation is the TCLP extract.
- L) The pH of this extract should be recorded.
- M) A small aliquot (about 10mls) is to be taken from the liquid and placed into a test tube. 2mls of Nitric acid should then be added to it. If precipitation is observed, then nitric acid is NOT to be added to the rest of the liquid. If no precipitation occurs, then the remaining liquid is to be acidified to a pH of <2.0

Extraction Fluid Prep

- A) Extraction Fluid #1
 1. Add 11.4 ml of Glacial acetic acid to 1L of DI water.
 2. Add 128.6 ml of 1N Sodium Hydroxide and dilute (with 860mls of DI water) to a volume of 2 liter.
 3. The pH of this fluid will be 4.93 ± 0.05
 4. Check the pH to be sure it is correct.
- B) Extraction Fluid #2
 1. Dilute 11.4 ml of Glacial Acetic acid with DI water to a volume of 2 liter.
 2. The pH of this fluid will be 2.88 ± 0.05 .
 3. Check the pH to be sure it is correct.

Notes

1. The pH must be checked prior to each use to ensure that it is still correct.
2. If the pH is not within the above specifications, it must be thrown out and a new batch must be prepared.

QA/QC

1. One blank (using the same extraction fluid as used for samples) must be analyzed for every 20 extractions conducted in the vessel.

A minimum of one matrix spike must be analyzed for each analytical batch. The matrix spike is to be added after filtration of the TCLP extract. Matrix spikes should be added at a concentration equivalent to the regulatory level.

5.9. Glassware Clean-up

IATL no longer uses glassware except in the preparation of standards. Good laboratory practices include the periodic inspection of all glassware for safety considerations. Glassware must be cleaned immediately after use. Below are procedures and routine schedules for glassware cleaning:

5.9.1. Daily Cleaning (Glassware is no longer used in sample preparation)

- a. Glassware is rinsed with deionized water (DI).
- b. Soapy water solution is then added and flask/bottle brush employed.
- c. Tap or DI water rinse to remove all soap
- d. 20% nitric rinse, followed by a
- e. final rinse with DI water
- f. Air dry.

5.9.2. New Glassware

- a. New glassware is opened and undergoes the following cleaning regimen before being placed into use.
- b. Soapy water solution is added and flask/bottle brush employed.
- c. Tap or DI water rinse to remove all soap
- d. 20% nitric rinse, followed by a
- e. final rinse with DI water
- f. air dry.

5.10. Method Addendums / Procedure to Alter or Proprietary Methods

There are four ways in which analytical methods are reviewed and audited as a prerequisite to amendments and revision. A complete discussion is found in Section ii.2 and ii.3. Regular staff meetings serve as focal points for final presentations by individual staff and/or management to propose changes in SOPs etc. Reports are read with recommendations for change and amendments. These are taken under consideration by the Laboratory Director and the QA Coordinator to determine worthiness of the proposed changes. Other meetings (e.g. AAS Staff three times annually) are utilized to further refine proposed lab policy and procedures. Other means of review include the ELLAP checklist, NJDEP checklist, on-site evaluation reviews, and technical updates in the literature.

The review process may conclude that certain items, sections, practices, etc., be revised and amended. These are incorporated in the SOP QA Manual only after approval of Laboratory Director with review by Health & Safety Officer, QA/QC Coordinator and Certified Industrial Hygienist. If analytical procedures or methods change, then subsequent studies using standards and blanks must be run to review the effectiveness of proposed changes on analytical validity. The data from such studies will be filed and cited with the Manual changes as "see AAS.95.TESTRUN.01/01/95" or similar notation.

Revisions will be incorporated into the SOP and QA Manual by the following mechanism:

1. Submittal of proposed changes to the Laboratory Director in writing.
2. Experimental validation (if necessary) and data review by QA Coordinator, Linear calibration ranges are established and routinely verified for each method. (see also Sec. 3.5.2)
3. Review of Health & Safety Officer of such impact.
4. Notation of changes by TESTRUN file and Chemical Hygiene Plan file,
5. Approval by all signatories and revision of new dated Title Page to Manual,
6. Revision and newly dated Table of Contents to Manual
7. Revision of whole section affected in Manual with new dates.
8. Footnote: Revision ID, Software file ID, date change. (see Sec. ii.2 and ii.3)
9. *SOPs are dated and approved by the Technical Manager.*

5.11 New Method Implementation

In the event that a new method is required IATL looks first to published methods which have been established and accepted by our accrediting bodies.

6.0 Sample Analysis

This section of the SOP and QA Manual concerns itself with the instrumental analysis of prepared samples. Thus it is assumed that either flame or furnace analysis will be performed on properly prepared samples.

These sections are arranged by instrument condition: supply gases, computer program notes, sample to spectrometer procedures, standards and calibration, and other instrument considerations.

Finally, this section ends with guidance on data entry for daily analytical worksheets, instrument trouble-shooting, and Daily AAS Log.

6.1 Instrument Set-up: FLAME AAS

All Laboratory Training Program (LTP) activities must be completed for Level I and Level II Analysts before the instrument can be run. This shall include all safety considerations and important Perkin-Elmer instrument directions.

Analytical calibration and analysis parameters have been established and stored to ensure consistency and ease of use for all analyst levels. For a detailed setup procedure the technical manual should be consulted.

The analyst's activities during flame analysis will include, but are not limited to the following:

1. Setup the Flame AAS in accordance with the Perkin-Elmer operations manual as required. This includes the nebulizer alignment, all tubing and line placement, and all acetylene and compressed air hook-ups. If parts or hook-ups need cleaning or service attend to them prior to running samples! Acetylene tank pressure set at > 75psi. and line pressure at 15 psi.
2. Turn the power on at the power conditioner to start the instrument.
Turn the PC on after a few seconds then double click on WinLab 32 at Windows Desktop.
3. Open Workspace "Pb".
4. Allow at least 1 hr warm-up time for the lamp.
5. On the Continuous Graphics window click on autozero. On the Flame Control window start flame. Auto-zero. Aspirate a blank solution of DI water and HNO₃. Aspirate a 20. ppm standard and adjust the nebulizer, burner, or lamp if necessary to optimize absorbance reading above 0.220.
6. Go to Manual Control window and turn on 'print results' option. Then turn on 'save data' option. Click on the 'open' button and name the data file as the current day's run date (yymmdd).
7. Go to Manual Control window to run calibration blank (F5) and calibration standards (F6).
8. Aspirate a blank solution and autozero the instrument. Aspirate each standard and depress the F6 key to analyze each standard and generate a calibration curve. Record the absorbance value of the 20.0 mg/L standard in the instrument log.
9. Aspirate a blank solution to insure that a good baseline has been established. Auto-zero until constant zero.
10. Turn off 'print results' option and analyze initial calibration checks. Recalibrate if out of range.
11. Read all of the samples, blanks, spikes, and continuing calibration standards as required.
Considerations during analysis and potential concerns may include:
 - a. Standards outside of acceptable range. (See Section 4.5)
 - b. Blanks indicating target analyte over acceptable levels. (See Section 4.5)
 - c. Samples that have absorbance readings out of the range of the calibrated linear curve. These may require dilution. (See Section 6.3.5)
12. Complete the instrument log at the end of the analysis, and insure that the instrument has been properly shutdown.
13. Complete all quality control worksheets and submit results for review by the laboratory director.
14. SHUTDOWN:

Flame off, Gases off, and computer off. Turn power conditioner off, not the instrument.

6.2 Instrument Set-up FURNACE AAS

All Laboratory Training Program (LTP) activities must be completed for Level I and Level II Analysts before the instrument can be run. This shall include all safety considerations and important Perkin-Elmer instrument directions.

The analyst's activities during furnace analysis will include, but are not limited to the following:

1. Replace Flame assembly with AS70.
2. Turn on Argon (40 psi) and water on the back wall (only ¼ turn).
3. Turn on, HGA, Photometer, Computer, and printer. (If the computer is already on type "AAS" and hit [enter])
4. Set Lamp Current to 8 mA
5. Change to Furnace Analysis [F2].
6. Press [Program Element].
7. Type in "gfpb" and hit [enter]. Press recall file [F2].
8. Press [Data Management].
9. Type in "gfpb" and hit [enter] then hit ID/WT [F1]
10. Input sample numbers and check standards as needed (see below for post spiking).
11. With the arrow keys move the cursor to the top of the screen and highlight "gfpb".
12. Enter the month and day (mmdd) and hit [enter] then save file [F2]
13. Press [Program Element]
14. For both the "Data File" and the "ID/WT File" enter the month and day (mmdd)
15. Press [Setup].
16. Adjust lamp for maximum energy and press [gain]. (Repeat as needed.)
17. Press [Run Element]
18. Press [F10 / Sampler Control]
19. Press [Print] to turn the printer on, [F1].
20. Press [F8] to get back to main keys.
21. Press [F4] to start calibration. Standards and Samples can be loaded into the rack as the instrument calibrates.
22. Calibration should be linear with a correlation coefficient not less than. 0.998
23. Enter the range of positions in the rack to be run. (i.e. 6-40) Press "run samples" [F1]
24. Check printout for acceptable QC results and consistent sample replication.
25. Shutdown: Press [Element Select], [F1], [F4], [F1].
26. Turn off; water, argon, printer, monitor, Spectrophotometer, and HGA.

One sample from each client project must be followed by a post spike. See section 5.5 'Sample Matrix Preparation: Water' for spiking procedure.

6.3. Worksheet Data Entry

This sub-section does not deal with final certificate of analyses, nor the review and report proofing process. Instead this section concerns only the technician recording sample identifications, initial gravimetric or other sample specific data, the instrument reading, and the initial reporting of those readings. This reporting utilizes standard calculations for metals or environmental lead concentrations in various matrices found in a later section.

A COMPLETE LISTING OF VERIFIED CALCULATIONS IS GIVEN IN SECTION 7.2.

6.3.1. The Daily AAS Run Worksheets - For each matrix analyzed a specific form exists in the 'AAS Data Worksheets' spreadsheet. (see attached examples) Forms are filled out by the technician(s) at various stages of prep and analysis. By using spreadsheets the date of sample preparation and the initials of all of the technicians involved need be entered only once to fill out all forms. The worksheets are designed to fill down sequential sample numbers after the starting sample number has been entered. When all sampling and analysis data has been entered all calculations are performed automatically.

6.3.2. Initial Data - Paint and soil samples are weighed-out in the analytical balance to 0.0001g. The gravimetric data is recorded in the appropriate column in (mg). In the case of air and wipe samples, sampling data is recorded in Column N under the comments section. Blanks are indicated as "FB" in Column N under the comments section.

6.3.3. Instrument Reading - This is recorded in the "Concentration" column. The instrument gives absorbance readings to three decimal places and analyte concentration in mg/L displayed to two decimal places. It is the latter data that is recorded and used for calculations. Values less than the reporting limit are to be recorded as 0 (zero) and may be lined down in the case of consecutive samples.

6.3.5. Serial Dilution - Samples that have absorbance readings above that of the highest standard may require dilution. The AAS Room has Eppendorf pipettes, 15ml graduated tubes, and a re-pipette of DI water for this process. IATL technicians generally dilute in factors of 10. Thus reporting a 1:10 dilution means a 10 times dilution factor. Recording 1:20 translates into a 20 times dilution factor. This dilution factor is incorporated into the result calculation.

6.3.6. Submittal of Raw Data - Following analysis raw data is entered into the AAS Data Worksheet. This spreadsheet is stored on a file server using a yymmdd naming convention. When complete these sheets are printed and presented to the Reports staff for LIMS entry. For all reported results two significant figures are used.

IATL supplies its clients with preliminary results as a way for them to expedite decision making. All preliminary results are submitted with a disclaimer intended to inform / remind the client that only the final signed written report is to be considered the official results. All data, QC, and reports are reviewed and validated by trained personnel prior to release for mail out.

ANALYZED CONCENTRATIONS BELOW THE LOWEST CALIBRATION STANDARD ARE CALCULATED USING THE CONCENTRATION OF THE LOWEST STANDARD AND REPORTED WITH A "<" PROCEEDING THIS VALUE!!

Results may or may not be reviewed by the Laboratory Director prior to faxing. The worksheets are finally filed by date in the AAS Library.

6.4. Instrument Trouble Shooting / Log

A Daily AAS Log is kept in the AAS Room. This log details the daily operation of the instrument, standards preparation, maintenance, and other note-worthy observations. The Perkin-Elmer Analyst 400 is under full manufacturer's service contract. The agreement calls for unlimited emergency calls. Usual response time is within 24 hours. A copy of this agreement is located in the Laboratory Director's file top draw under PE Current. Phone numbers of the PE technician are posted in the AAS Room.

Typical troubleshooting lists are posted in the AAS Room. They include procedures for dealing with the following, if non-routine maintenance is required than the PE service representative is paged and analysis is not to be performed until the operator can ensure reliable results. Regardless of the corrective action, Initial Calibration Check standards must be reanalyzed to confirm the integrity of the curve. If standards fall outside of the limits of acceptability the instrument must be re-calibrated employing the complete procedure for that operation. Potential problems concern:

- 6.4.1. Nebulizer may be clogged. Cleaning required.
- 6.4.2. External pressure regulating devices may be not set or on or tank may need changing.
- 6.4.3. Optical system capable of isolating the desired wavelength of light radiation may need aligning.
- 6.4.4. A detector and photomultiplier tube may be burnt-out and need to be replaced.
- 6.4.5. Adjustable slit may be set high or low.
- 6.4.6. Computer interface may not boot up properly.
- 6.4.7. Hollow cathode lamp may need to be replaced.
- 6.4.8. Furnace tube may require replacement.
- 6.4.9. Water supply may not be switched on.
- 6.4.10. Constant cylinder purge gas may be low: Argon replacement.

The set-up, operation, routine maintenance, and other instrument related parameters are covered in the Laboratory Training Program (LTP) for Level II and III Analysts.

OPERATION OF THE AAS IS COVERED IN SECTION 6

7.0 Quality Control

The goal of any company is to build a growing thriving business. IATL has been able to achieve this by giving clients quality results in a timely manner. So, it is the objective of the QC program to ensure that a quality system is present and verifiable. Initiating and maintaining quality in the lab is easy! It only requires discipline and dedication by technical staff to do 'it' and the same commitment by the management team to see that 'it' is done.

The Quality Assurance/Quality Control (QA/QC) Program established in this section of the SOPs and QA Manual are of utmost importance at IATL. IATL adheres to all stated QA/QC requirements as published in the method being used. Company management demonstrates this commitment to quality in all areas including facilities, hiring qualified staff, training programs, and constant review during preparation, analyses, and reporting of samples. QA procedures are constantly being reviewed and updated (see Section ii.2 & 5.7).

References to quality statements, staffing, organizational charts, job descriptions, training, preparation and analysis procedures, are all found elsewhere in this document. This section will concentrate only on the QC Sample classifications, Calculations and Data Handling, Proficiency Programs, InterLaboratory QC Program, QC Data Presentation, Preventative and Corrective Actions, and Customer Complaints.

This section was written with the following guidelines as a resource.

- NJDEP, Office of Quality Assurance, Regulations Governing Laboratory Certification and Standards of Performance, NJAC 7:18 July 1984
- EPA, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80)
- EPA/HUD, Lead Based Paint Guideline for Identification and Abatement, March 6, 1990.
- ASTM D-3335-85a, Test method for Low Concentration of Lead in Paint by Atomic Absorption Spectrometry, 1985.
- EPA, Reference Method for the Determination of Lead in Suspended Particulate Matter Collected from Ambient Air, 40CFR Part 50, Appendix G.
- NIOSH 7082, Lead in Air Collected on Cellulose Ester Filters by AAS-Flame, 1990
- NIOSH 7105, Lead in Air Collected on Cellulose Ester Filters by AAS-Furnace, 1990
- EPA SW-846:7420, Lead in Paint Soil by AAS-Flame, 1990
- EPA SW 846:7421, Lead in Paint by AAS-Furnace, 1990
- Environmental Compliance Reporter:
- ISO 25 Guidelines for Accrediting Laboratories, 1990
- ISO17025 Guidelines for Accrediting Laboratories, 1999

7.1 QC Sample Definitions

The chart below is a summary of QC samples that must be prepared and analyzed with each run of metals or environmental lead samples. These include Standards, Blanks, Duplicates, Spikes, and other control samples. Further definitions can be found in Section 4.1 - 4.6.

Table 7.1.1 Quality Control and Process Control Samples

QC Sample Type	Definition	Frequency
Reagent Blank	A sample consisting of only the reagents used for preparation. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination.	1 per analytical run per prep volume. (Air – 10 ml, Paint, soil, and wipe – 50 ml)
Matrix Blanks	A matrix blank is a paint, wipe, air, or soil that is documented to contain no lead. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination.	1 per analytical run per matrix type.
Method Blanks	A sample consisting of only the reagents used for a specific matrix. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination.	1 per 20 samples per matrix type. Minimum of 1 per batch.
Sample Spike	A portion of a sample is fortified with all target analytes before preparation and analyzed.	1 per 20 samples per matrix type. Minimum of 1 per batch.
Post Spike	A portion of a sample is fortified with all target analytes after preparation and analyzed.	GFAA – 1 sample of concentration < 16ppb per project. Flame – No recovery sample
Laboratory Control Samples (LCS)	A matrix based reference material to be prepared and analyzed parallel to client samples.	1 per 20 samples per matrix type. Minimum of 1 per batch.
Laboratory Control Samples Duplicate	A second Standard Reference Materials used to represent a matrix or to fortify a matrix. (Air & Wipe Matrices precision & bias)	1 in 20 samples per matrix. Minimum 1 per batch.
Matrix Spikes	Standard Reference Materials used to represent a matrix or to fortify a matrix.	1 per analytical run for each matrix to be analyzed.
Sample Duplicate	A second portion of a sample prepared and analyzed parallel to the initial subsample.	1 in 20 samples per matrix. Minimum 1 per batch.
Sample Replicate	An analyzed sample is re-analyzed at the end of the batch, and reported. This is done to further check instrument variability.	1 in 20 samples.
Reporting Limit Verification Sample Matrix Spike (RLX)	A matrix spike prepared to demonstrate the ability to recover analyte at the reporting limit. (0.2 mg/L analyzed concentration)	1 per matrix per analytical run. Within 20% acceptable.
Lab Surface Contamination Check (LCC)	This sample (see section 5.1) is produced after each day's preparation of samples. A Ghost wipe is used to wipe the balance area before and after cleaning. This is used to monitor lab contamination.	2 per analytical run
Monthly Lab Contamination Check (MLCC)	These samples are produced monthly in various areas of operation in the lab. This is to further monitor lab contamination. Ghost wipes are used.	1 per month

Table 7.1.2 Instrumental Quality Control Standards and Specifications

QC Sample Type	Use	Specification
Initial Calibration Blank (ICB)	Initial calibration and zeroing instrument response.	Calibration standard which contains no analyte.
Calibration Standards	Used to calibrate instrument by linear curve construction.	Must be matrix matched to acid content present in digestates. Must measure prior to measuring any digestates. Correlation coefficient of >0.998, as measured using linear regression on instrument response (y) versus concentration (x).
Initial Calibration Verification (ICV)	Used to verify calibration standard levels.	Concentration of analyte to be near midrange of linear curve. The ICV is made from a stock solution having different manufacturer or different lot ID than the calibration standards. Must be measured after calibration and before measuring any sample digestates. Measured value to fall within a 10% of known value.
Continuing Calibration Verification (CCV)	Used to verify freedom from excessive instrument drift.	Concentration to be near levels of concern. Must be analyzed at run end and at a frequency not less than every 20 samples. Measured value to fall within 10% of known value for flame AAS or 20% for furnace.
Continuing Calibration Blank (CCB)	Used to verify blank response and freedom from contamination or carryover.	Calibration standard that contains no analyte. Must be analyzed after the CCV and ICS. Measured value to be less than 5 times the instrument detection limit.

7.2. Quality Practices

Initiating and maintaining quality in the AAS laboratory is easy! It only requires discipline and dedication by technical staff to do 'it' and the same commitment by the management team to see that 'it' is done. The systems and routines that must be followed are not complicated. Quite simply... the variables that might affect an analysis are 'controlled' by comparison, calibration, and competence. That is, the variables of samples, instrument, preparation methods and associated analyst skills, and the reporting of the observations and qualitative/quantitative results are all required to be assessed. This section will give detailed instructions regarding the routines and systems that assess and measure these three C's: *calibration, comparison, and competence!*

Several mechanisms have been employed to check that quality results are being obtained. These include the incorporation of all of the QC Sample types described in Section 7.1. The data collected from these control samples are recorded and tracked using control charts and other statistical tools. (see Section 7.6). Each day the Daily QC Worksheet and Daily AAS Worksheet are reviewed and signed-off by either the QA Coordinator or the Laboratory Director. Once per month, the QC data is plotted, a QC Report issued and distributed to all AAS staff. Corrective actions (see Section 7.7) may be developed at any time, but are most effectively communicated after the data has been properly compiled. The QC data may warrant changes in procedures or set-ups. QC data is divided into instrument related QC as well as Sample Process data for each matrix type.

As mentioned previously, the third 'C' is competence. The overall competence of individuals and laboratory maybe difficult to measure. The step-by-step process of daily analysis present several opportunities to measure accuracy and precision. These measurements will reflect the competence of staff. Initial hiring, ethical behavior and reinforcement, training practices, and continued exposure to technical upgrades all are part of the competence through staff training program at IATL. The Laboratory Training Program can be found in Section 1 of this manual.

The above 'C's may be referred to as a Quality Assurance definition. Moreover, attention to the system of 'assurances' and 'control' responses further defines Preventative Actions. This proactive stance adopted by the laboratory assures that all levels of staff from management to technician know their place in the scope of the laboratory's objectives for Quality. Preventative Actions include all items that will identify, recognize, and control potential sources of nonconformance. See also section ii (amending QA Manual, SOPs) Section 7.7 (Preventative / Corrective Actions), Section 1.6 (Laboratory Training Program).

7.2.1. Accuracy - Investigations are performed to determine how close a measurement comes to an actual or accepted reference value. Accuracy can be expressed as percent recovery and evaluated by analysis of matrix spike samples. A matrix spike is an aliquot of a sample fortified with a known quantity of the analyte of interest and subjected to the entire analytical procedure. For dust/wipe samples, blank collection material is utilized.

7.2.2. Precision - Precision is evaluated by the reproducibility of analyses. Precision is commonly expressed as standard deviation or relative percent difference (RPD) and can be evaluated by the analysis of duplicate samples. Duplicate sample analyses are one or more additional analyses on separate portions of a given sample in order to assist in the evaluation of method variance. For dust/wipe samples, blank collection material spiked in duplicate.

7.2.3. Uncertainty - Uncertainty is used to determine the range of dispersion that could reasonably be attributed to sample results. In accordance with ISO 17025 section 5.4.6 IATL has produced an Uncertainty Budget comprised of the sources of uncertainty in the lab. The final value is calculated by the root-sum-of-squares (RSS) method and is expressed as the expanded uncertainty (U_c), or the Best Measurement Capability (BMC). This is the value used as part of a statement on the client COA to accompany analytical measurements.

7.2.4. Method Blanks - IATL runs at least one method blank per every 20 samples. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination. These blanks may also be termed digestion blanks or reagent blanks.

- 7.2.4. Field Blanks – Client field blanks are analyzed along side all other samples. Blank correction is not performed on samples related to a given field blank. Clients are informed by annotation on their preliminary results in the event that field blanks are not submitted with wipe or air samples.
- 7.2.5. Laboratory Control Samples – (LCS) An SRM fortified sample is analyzed with each matrix batch at the 5% level for sample batches larger than 20. Again, if fewer than 20 samples are prepared, at least one sample must be of this type. The concentration of the sample must be within the working range of calibration. It is not required that the source be NIST traceable, but these samples must at least be old PAT rounds or other samples with published and verifiable results.
- 7.2.6. Matrix Blanks - IATL runs at least one matrix blank for every 20 samples (air/wipe). A matrix blank is a wipe material or air filter documented to contain no lead. These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination. If fewer than 20 samples are run, than at least one of these samples is employed.
- 7.2.7. Reporting Level Verification Spikes - For each matrix analyzed a matrix blank is to be spiked at the level of the lowest calibration standard. These samples are to be prepared parallel to client samples at a frequency of once per day. Liquid spiking is acceptable.
- 7.2.8. Post Spikes – (PS) Directly following the analysis of a water sample a post spike is analyzed to insure that results are not suppressed by matrix interference. One sample having a concentration of 16 ppb or less must be spiked and yield a recovery of 90% to 110% per client project. Recoveries outside of limits require sample dilution and reanalysis and post spike. Repeat this process until recoveries are within limits.

All of the above QC sample types must be prepared parallel to the actual run of samples. Acceptable performance limits are posted in the AAS Room, and are evaluated statistically by the Laboratory Director at least monthly for instrument, method, and QC sample type. The QA Coordinator or the Laboratory Director utilizes a software product [Microsoft Excel] to evaluate the QC data. Acceptable limits and the frequency of use are stated in Table 7.1.1 and 7.1.2.

7.3 Calculations

The QA Coordinator or the Laboratory Director utilizes MS Excel to evaluate the QC data. Customized software in the Laboratory Information Management System (LIMS) is also utilized for this purpose.

Once the analyst generates results from the instrument, established calculations are used to derive concentrations for reporting to clients. These calculations are posted in the AAS Room. The analyst has both calculator and a customized and verified spreadsheet program that will perform most result calculations.

The software allows protection against alterations to key calculation fields to ensure consistent and accurate results.

7.3.1 Air Sample Calculations

Results of lead analysis in air samples must be expressed in terms of micrograms per cubic meter ($\mu\text{g}/\text{M}^3$) of air in order for comparisons with regulatory guidelines. (NIOSH 7082) The air volume can be calculated using the start and stop times for sample collection and the air flow rate.

The concentration of metal in air is calculated as follows:

$$\frac{Q \text{ (mg)}}{\text{(L)}} \times \frac{D \text{ (L)}}{V \text{ (L)}} \times \frac{1000 \mu\text{g}}{1 \text{ mg}} \times \frac{1000 \text{ L}}{1 \text{ M}^3} = X \mu\text{g}/\text{M}^3$$

where: Q = concentration of analyte from the instrument reading in mg/L
D = dilution of sample (e.g. for air sample usually brought up to 10ml or 0.01L)
V = volume of air drawn through filter material (as supplied by client) in L
X = final calculated concentration in $\mu\text{g}/\text{M}^3$

IATL technicians frequently utilize a spreadsheet program to calculate and/or check client calculations for air volumes. This same program will also calculate concentration results by inputting the dilution D, instrument reading Q and volume of air V. The software allows protection against alterations to key calculation fields to ensure consistent and accurate results.

7.3.2 Paint Chip Sample Calculations

Results of lead analysis in paint must be expressed in terms of either percent of sample weight or parts per million as expressed in milligrams of analyte per kilograms of material sub-sampled. The EPA/HUD regulatory guidelines are 0.5% lead by weight lead content.

$$\frac{Q \text{ (mg)}}{\text{(L)}} \times \frac{D \text{ (L)}}{\text{tm (mg)}} \times 100\% = X \% \text{ total mass}$$

where: Q = concentration of analyte from the instrument reading in mg/L
D = dilution of sample (e.g. for paint sample usually brought up to 50 ml or 0.050 L)
tm = total mass of sub-sample in milligrams
X = concentration in either % by weight or ppm

IATL technicians utilize a spreadsheet program to calculate concentrations for results by inputting the dilution D, instrument reading Q and initial gravimetric data tm. The software allows protection against alterations to key calculation fields to ensure consistent and accurate results.

7.3.3 Dust/Wipe Sample Calculations

Results of lead analysis in dust/wipe must be expressed in terms of micrograms of lead per square footage of area samples

$$\frac{Q \text{ (mg)}}{(L)} \times D \text{ (L)} \times \frac{1000 \mu\text{g}}{1 \text{ mg}} \times \frac{1}{A \text{ ft}^2} = X \text{ } \mu\text{g/ft}^2$$

where: Q = concentration of analyte from the instrument reading in mg/L
D = dilution of sample (e.g. for wipe sample usually brought up to 50ml or 0.050L)
A = total area of sample in square feet
X = reported concentration in $\mu\text{g/ft}^2$

IATL technicians utilize a spreadsheet to calculate and/or check client calculations for area sampled. This same spreadsheet is used to calculate concentrations for results by imputing the dilution D, instrument reading Q and area sampled at. The software allows protection against alterations to key calculation fields to ensure consistent and accurate results.

7.3.4 Soil Sample Calculations

Results of lead analysis in soil must be expressed in terms of either parts per million as expressed in milligrams of analyte per kilograms of material sub-sampled. The EPA regulatory guidelines may vary by the SW846 7021 Method.

$$\frac{Q \text{ (mg)}}{(L)} \times \frac{D \text{ (L)}}{\text{tm (mg)}} \times \frac{1,000,000 \text{ mg}}{1 \text{ Kg}} = X \text{ mg/kg or ppm}$$

where: Q = concentration of analyte from the instrument reading in mg/L
D = dilution of sample (e.g. for soil sample usually brought up to 100ml or 0.100L)
tm = total mass of sub-sample in milligrams
X = concentration in ppm

IATL technicians utilize a spreadsheet to calculate concentrations for results by imputing the instrument reading Q and initial gravimetric data tm. The software allows protection against alterations to key calculation fields to ensure consistent and accurate results.

7.3.5 Potable Water Sample Calculations

Results of lead analysis in water must be expressed in terms of either parts per billion as expressed in micrograms of analyte per Liter of material sub-sampled. The EPA regulatory guidelines may vary by Method.

where: X = concentration in ppb

7.3.6 Percent Recovery

The spiked sample analyses determine the extent of instrument bias in the analysis procedure. This consists of a non-field blank sample. In the case of paint, soil, and TSP air samples the first sample of the page to have sufficient quantity for reanalysis is selected for spiking. Sample duplication is generally also done on this sample for an added level of result confidence. The concentration of the non-spiked sample, is taken to be zero if the lead content is less than the method detection limit. The percent recovery is calculated as:

LBP / Soil:

$$\frac{[\text{Spiked Value (mg/L)} - \text{Non-Spiked Value (mg/L)}]}{\text{Actual Spike Value (mg/L)}} \times 100 = \% \text{ recovery}$$

Non-Spiked Value:

$$\frac{\text{Sample Conc. (mg)}}{\text{(L)}} \times \frac{\text{MS wt. (mg)}}{\text{Sample wt. (mg)}} = \text{Non-Spiked Value (mg/L)}$$

Actual Spike Value:

$$\frac{\text{Std Conc. (mg)}}{\text{(L)}} \times \frac{\text{spike vol. (mL)}}{\text{Final vol. (mL)}} = \text{Spike conc. (mg/L)}$$

An acceptable range of percent recovery is based on the statistical results of the previous year. Failure of a sample spike can generally be attributed to samples consisting of multiple layers or having substantial inseparable substrate. If neither of the above is noted during sample preparation then matrix interference may be suspected. For atomic absorption analyses, the method of standard additions (MSA) should be used in analysis of the sample. If the correlation coefficient of the MSA is less than 0.995, the sample should be diluted by a factor of two and the MSA repeated. Spike sample analysis should be performed on 5% of the analyzed samples, or at least once per analysis set, whichever is more frequent. Spike sample analysis should also be performed whenever a new sample matrix is considered.

Spike Recoveries for Air and Wipe sample spikes are calculated using the following equation:

$$(C_a / C_t) * 100\% = \text{Percent Recovery}$$

C_a = Actual concentration.

C_t = Theoretical concentration.

7.3.7. Relative Percent Difference

Duplicate sample, replicate analysis and LCS duplicate (LCSD) analyses estimate the precision of the results. Duplicates are performed at a frequency of once for every 20 samples or at least once per analysis set, whichever is more frequent. The acceptable range for precision is an RPD of 20%.

Relative Percent Difference will be calculated for all duplicates and replicates:

RPD:

$$\frac{[\text{Sample (mg/L)} - \text{Dup/Rep (mg/L)}]}{[\text{Sample (mg/L)} + \text{Dup/Rep (mg/L)}] / 2} \times 100 \% = \text{Relative Percent Difference}$$

7.3.8. Miscellaneous Calculations

Field Blank Calculations (flame only)

$$\text{(wipe)} \quad \frac{Q \text{ mg}}{L} \times 0.050 \text{ L} \times \frac{1000 \text{ } \mu\text{g}}{1 \text{ mg}} = X \text{ } \mu\text{g}$$

$$\text{(air)} \quad \frac{Q \text{ mg}}{L} \times 0.010 \text{ L} \times \frac{1000 \text{ } \mu\text{g}}{1 \text{ mg}} = X \text{ } \mu\text{g}$$

Acceptance Limits Calculations

$$(\text{avg. annual result}) + 3 * \text{Std. Dev.} = \text{Upper Acceptance Limit}$$

$$(\text{avg. annual result}) - 3 * \text{Std. Dev.} = \text{Lower Acceptance Limit}$$

7.3.9. Equivalency Table

$$\text{ppm} = \text{mg/L}$$

$$1 \text{ kg} = 1000 \text{ g}$$

$$\text{ppb} = \text{ } \mu\text{g/L}$$

$$1 \text{ g} = 1000 \text{ mg}$$

$$1 \text{ mg} = 1000 \text{ } \mu\text{g}$$

7.4 Preliminary Results

Once the analyst has completed the analytical steps listed for preparation and analysis of both client samples and QC samples they must next enter that data into the AAS Worksheet spreadsheet. FOR NON-DETECTED RESULTS SEE SECTION 6.3.6. Once all analysis data has been entered and reviewed by the analyst, worksheets can be printed out. It is assumed that all criteria for analytical set-up, both instrument and QC samples will have been met. It is also assumed that the acceptance criteria for QC samples will have been achieved. If any instrument or QC sample parameter is breached, than a thorough review by the QA Coordinator and Laboratory Director will follow with a filed written report noted in the Corrective Actions File. For further details on Corrective Actions, see Section 7.7.

The analyst now has printed worksheets. These are delivered to the clerical staff for entry into the LIMs software. COAs are then printed and preliminary results are faxed to the client along with a Preliminary Results Disclaimer which clearly states that these results may not have been review and only the final signed COAs represent our final results. See sec. 9.3 regarding confidentiality.

7.5 Data Validation

Within one to five days the analytical run is validated by comparing the raw data to the calculated run sheets to ensure accurate transcription and acceptable QC results. Following validation the client paperwork is reviewed to ensure that COAs accurately represent sample results and client supplied information. It is only after this process has been successfully completed that results are officially released in the form of signed COAs.

Any corrections made following the clients receipt of preliminary results will require notification of the client in a timely manner. Quality Control outliers that will affect analytical data will be recorded in Corrective Action reports, control charts, noted on worksheets, and signed-off by Analyst and QA Coordinator. Computer data files that are changed or edited might be QA data and final computer generated COA reports. Only certain office personnel are privileged and security permitted to access these computer files. None of the laboratory analysts have these security permissions. Documentation of any changes can be listed on the LIMS log by date of change, who accessed and edited, and who approved or validated any changes.

Periodically the QA Coordinator or Laboratory Director must verify the MS Excel spreadsheet to ensure accurate calculations. The software is checked using all "1.0" entries which should produce the same verified result daily. If it does not, than the Laboratory Director must correct formula and determine what data has been affected. If pass than may proceed with client review of COA. If verified entry fails than see corrective actions Section 7.7. This may mean re-prepping or re-analyzing archived samples if outliers are detected.

IATL WILL NOT REPORT RESULTS WHERE ASSOCIATED QC SAMPLES FALL OUTSIDE ACCEPTED CRITERIA.

Client COA Reviewer checks:

- 7.5.1 Client name, number, address, and contact person.
- 7.5.2 Chain of Custody complete including receipt, login, analysis, reporting, QC review, and issue of report dates and signatures.
- 7.5.3 Format of COA for particular analyte and matrix.
- 7.5.4 Client sample ID, IATL sample ID.
- 7.5.5 Location, description, color, etc.
- 7.5.6 Volume, area, or initial mass calculation check.
- 7.5.7 Raw data to final result concentration calculation check.
- 7.5.8 Significant figures, LOQ, and other relevant data.
- 7.5.9 Any notes that must be included or disclaimer relevant to sample size, matrix/substrate interference, or insufficient sample size.
- 7.5.10 Analyst signature and date.
- 7.5.11 Reviewer signature and date.

All Daily QC Worksheets and Daily AAS Worksheets are filed by date. The QC statistics are stored electronically on a network drive. All LIMS data is archived. (see Section 2.3) Only monthly control charts etc. are printed-out and filed with QC reports.

Corrections or additions may arise from client requests. These changes from original sample log or chain-of-custody paperwork must be accompanied by a FAX from the client authorizing the change. If a correction or addition is made to a test report, a copy of the initial report [stamped COPY] and the newly amended report are both filed in the client's monthly file. Amended reports are given a new report number and include a disclaimer noting their amended status as well as reference to the initial report number and date.

7.6. QC Records / Analysis

There are only two forms that the analyst utilizes and that follow all metal and environmental lead sample preparation and analysis. These are the Daily QA/QC Worksheet and the Daily AAS Worksheet. Other QC records must be generated from data on the two worksheets. Any place where handwritten data, numbers, observations, results, etc. are entered onto paperwork must be completed in blue ink only. White-out[®] is strictly forbidden. Only a single ~~striethrough~~ with analyst initials and date is acceptable. In the case of electronic files corrections are made by adding or changing sampling data. Each sample changed should be annotated with a comment as to the change.

Records of all out-of-control events can be found as data with the Daily QA/QC Worksheet, the Daily AAS Run Worksheet, the Monthly QA Report, and graphically in outlier events notated through control charts. Any out-of-control event and its corrective action is notated and signed by the Analyst and the QA Coordinator.

- 7.6.1. Daily AAS Worksheet - This form (see attached) contains all IATL numbers, initial sample information (e.g. mass, volumes etc.) dilutions, instrument results and analyst comments. This form also has the required QC samples and continuing calibration checks standard and blank. (see Section 4 and 7.1)
- 7.6.2. Daily QA/QC Worksheet - This form contains all initial QC data that must be obtained before a run can be performed. It includes date of run, initials of preparation technicians and/or analyst technicians as well as a sign-off and date of the QA Coordinator or the Laboratory Director. Calibration blank, calibration standards, calibration verification standards, and initial QC samples (LCSs, Matrix Spikes, & Matrix Blanks) are all found here.
- 7.6.3. Accuracy - Accuracy is expressed in percent recovery of analyte in spiked samples. (see also section 7.1 and 7.3). If results are not within the acceptable range (80 - 120%) than a review by the Laboratory Director and/or his designees must take place and be documented. (See Section 7.7) The control charts are compiled monthly. These charts are filed with the annual AAS documentation files. Monthly summaries are also attached. This data is maintained for each type of matrix.
- 7.6.4. Precision - Precision is evaluated by the reproducibility of analyses. Precision is commonly expressed as standard deviation or relative percent difference (RPD) and can be evaluated by the analysis of duplicate samples. If results are not within the acceptable range (see Sec. 4 and 7.1 - 7.3) than a review by the Laboratory Director and/or his designees and must be documented. (see Section 7.7) Control charts are compiled monthly. These charts are filed with the daily AAS documentation files. Monthly summaries are also attached. This data is maintained for each type of matrix!
- 7.6.5. Method Blanks - These samples are prepared and analyzed parallel to regular samples as a check for reagent and general laboratory contamination. Other contamination checks (see Sec. 7.2.4) are also documented and summarized monthly by control chart and report.
- 7.6.6. Reference Materials - Standard reference materials and materials with well-established content (ELPAT PEs) are analyzed with each matrix batch (see Sec. 4 and 7.1). These are reviewed as to the percent recovery from published data. If results are not within the acceptable range (see Sec. 4 and 7.1 - 7.3) than a review by Laboratory Director and or his designees must take place and be documented. (see Section 7.7) The control charts are compiled monthly. These charts are filed with the daily AAS documentation files. Monthly summaries are also attached.

7.7 Nonconforming Test Work

NO DATA CAN BE REPORTED UNTIL ISSUES ARE RESOLVED!

In the event of a nonconformance being discovered following the issue of a report the client will be apprised of the error, a Quality Control Report will be generated, and a new report will be issued.

In most cases of nonconformance the resolution is found with the analyst or at sample login. Because IATL does not do field sampling the issues associated with sample quality are dealt with via a sample management report generated by the Login person and attached to the client's paperwork. Issues of sample homogeneity or consistency are often the source of QC sample nonconformance. Here a simple disclaimer will suffice. In other cases steps must be taken to correct a situation. Often these too are handled on the spot by the analyst without any negative impact on sample results. Annotations are made in the run sheets and / or the instrument log. In the rare case that QC nonconformance arises inexplicably the QC Coordinator or the Laboratory Director must be informed of the situation before preliminary results are released. At this point an evaluation of the nature and impact of the nonconformance is made. Should the halting of work be necessary work shall not resume without the approval of the Laboratory Director. If evaluation of the nonconformance suggests a likelihood of recurrence a Corrective Action Request should be initiated.

7.8 Corrective and Preventative Actions

Corrective action is the process of identifying, investigating, approving, implementing and validating measures to counter unacceptable departures from policies and procedures or out of control QA performance which can affect data quality.

Deficiencies cited in external assessments, internal audits, client complaints, and managerial reviews are documented. When appropriate a Corrective Action Request is generated. Although a Corrective Action Request may be initiated by any member of the staff it is typically done by the Quality Department or Laboratory Director. This document is used to record and initiate the actions required to avoid repeat departures from the quality system. Determination of the root cause of the deficiency is investigated, including the results of the investigation and the intended corrective action. Corrective Action Responses are available to show that the implemented corrective action is monitored for effectiveness. The Quality Assurance Coordinator (QAC) maintains these records. The Laboratory Director will ensure that the corrective actions are discharged within the agreed upon time frame. When nonconformance and departures from SOPs cause doubt about the laboratory's operations, the affected areas are promptly audited.

The Lab Director has responsibility for ensuring the lab's policies and procedures are adhered to. Arrangements for known and controlled departures from documented policies and procedures are allowed. Planned departures do not require audits, however, the departure will be fully documented by the QAC and include the reason for the departure, the effected SOP(s), the intended results of the departure and the actual results. If the data reported to the authority or client is affected adversely, it will be notified in writing. The corrective action procedure is used for documenting this process.

- 7.8.1 Corrective Action Request initiated by individual upon recognition of a problem.
- 7.8.2 Lab Director / QC Coordinator reviews and signs request form.
- 7.8.3 Duties of response assigned by the Lab Director.
- 7.8.4 Responsible Party investigates the issue to determine the root cause.
- 7.8.5 Possible courses of action suggested to Laboratory Director.
- 7.8.6 Approved actions are implemented and their effectiveness evaluated.
- 7.8.7 Periodic review and reevaluation are performed to confirm effectiveness.
- 7.8.8 CAR log updated to close out the corrective action entry.

Preventive actions include all items that will identify, recognize, and control potential sources of nonconformance. These actions will be handled in a manner similar to that of Corrective Actions. The formalities of the corrective action will not be documented until completion. At that time any documentation of analysis, experimentation, or observation can be submitted to the Laboratory director for review.

7.8 Corrective and Preventative Actions (continued)

The Lab Director can then approve any recommended changes in policy or procedure and submit everything to the QC Coordinator for filing and if needed document maintenance.

Table 7.8

Variable	Corrective Action
Sample Size Insufficient for QC or Analysis	Disclaimer(s) to follow sample. Noted on Worksheet and COA.
Matrix/substrate interference possible.	Disclaimer(s) to follow sample ID. Noted on Worksheet and COA.
Blank(s) not included with sample (wipes/airs)	Disclaimer(s) to follow sample. Noted on Worksheet and COA.
Method blanks indicate analyte in elevated levels. (5xIDL)	Entire batch may have to be re-done. Check vessel IDs, paperwork IDs, and continuing calibration blank. If continuing calibration blanks are elevated, than rinse and reanalyze CCBs. If necessary, re-zero and reanalyze applicable samples.
Continuing calibration standards out of acceptance range.	Redo calibration curve, start from beginning of instrument set-up, Re-make standards and repeat, call PE service technician if twice fails. **
Laboratory control standards are out of acceptable range.	Redo calibration curve, start from beginning of instrument set-up, Re-make standards and repeat, call PE service technician if twice fails. **
Spike sample percent recovery out of acceptable range.	If high, check reagent blank for contamination, entire run may be positive biased. If low, check matrix interferences, calibration standard's recoveries for 'lowness'. Instrument may have to be re-calibrated or preparation process may not have been effective in digestion step. **
Duplicate sample preps out of acceptable range (RPD)	Look for matrix effects. If homogeneous, than check vessel and sample IDs. Reanalyze sample and duplicate if required reprep remaining material to confirm results. **
Consumed wipe and air samples associated with bad prep cannot be re-prepped.	Submit QC Report to client indicating circumstances, results of blanks, contamination etc. Recommend re-test and analysis at no charge.
Preliminary Faxed Results released w/o QC approval.	Client is notified and corrections are released.
Review Process / Validation discovers error undetected through the analytical process.	Records of all out-of-control events and corrective actions can be found as data with the Daily QA/QC Worksheet, the Daily AAS Run Worksheet, the Monthly QA Report, and graphically in outlier events notated through control charts. Any out-of-control event and its corrective action is notated and signed by the Analyst and the QA Coordinator. Some of these raw data edits may precede any computer entry. Computer data entry files that are changed or edited might be QA data and final computer generated COA reports. Only certain office staff are permitted to access these computer files. Documentation of any changes can be listed on the LIMS log by date of change, who accessed and edited, and who approved or validated any changes.

** Also record on Control Chart for that month's data.

7.9. Proficiencies

As discussed earlier, IATL maintains QC in various ways including management support of facilities, staff, training, and operating reviews. IATL is constantly testing its capabilities for lapses in quality objectives. One method to assure continued quality is the participation in proficiency testing. To further insure quality results, IATL participates in several accreditation programs. Many of these programs require on-site evaluations, reviews of operating procedures, methods, staff etc. A few also require the laboratory to prepare, analyze, and report performance evaluations (PEs) or proficiency analysis tests (PATs) to assure these agencies of confidence in our operations and qualifications. Any PE or PAT samples are introduced into the laboratory regimen as blindly as possible. We attempt to perform with the same diligence as we impart upon client samples without regard to their 'special' nature.

7.9.1. AIHA-PAT

IATL has maintained accreditation by the American Industrial Hygiene Association (AIHA) since 1989. Laboratory evaluation consists of the submittal of SOPs, successful analysis of proficiency samples, and on-site auditing of personnel, facilities, and practices. Throughout our involvement with AIHA we have successfully passed quarterly PAT rounds for asbestos and metals in air: Cd, Cr, Pb, and Zn. AIHA requires strict adherence to staff and operating guidelines. IATL is pleased to be associated with this organization, supports it as a corporate member, and strives to further its goals through quality practices in our laboratory.

7.9.2. AIHA-ELPAT

IATL also maintains involvement with AIHA's administered Environmental Lead Proficiency Analytical Testing (ELPAT) program. We have participated since the first round of tests. This program was established under cooperation of AALA, AIHA, and the newly formed NLLAP requirements. This program sends out four rounds annually for lead in soil, paint, dust/wipe and air samples.

7.9.3. NYSDOH: ELAP

IATL has been associated with the New York State Department of Health's Environmental Laboratory Approval Program (ELAP) since 1989. We have maintained accreditation for several analytes and matrices since our involvement began. We have had four on-site evaluations from ELAP. Throughout our involvement with ELAP we have successfully passed quarterly PE rounds for asbestos and metals in various matrices. ELAP requires strict adherence to staff and operating guidelines.

7.9.4. NJDEP

IATL has been an accredited laboratory with the New Jersey Department of Environmental protection (NJDEP) since 1990. We have maintained accreditation by that state's Quality Assurance Department, passing all on-site evaluations. Throughout our involvement with NJDEP we have successfully passed PEs rounds for asbestos and metals in various matrices. IATL is pleased to be involved with this state run organization.

7.9.5. NVLAP

IATL has been recognized as a member of the National Institute for Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) since 1989. We have maintained accreditation through NVLAPs Technical Evaluation Committee. We have passed all seven on-site evaluations, even documenting a perfect score in January 1993. Throughout our NVLAP involvement with NVLAP we have successfully passed PAT rounds for asbestos in bulk and air samples. IATL participates in technical studies, attends conferences, and is involved in supplying NVLAP with information that might be defined as 'reference laboratory' in nature. NVLAP requires strict adherence to operating guidelines by staff and management. IATL is pleased to be associated with this organization and strives to further its goals through quality practices in our laboratory.

7.10. InterLaboratory QC Program

To prevent intra-laboratory bias, IATL is involved with several inter-laboratory relationships. These include the exchange of air, bulk, and metals samples with other accredited laboratories. Here, each laboratory is responsible to originate a round of samples each year. The exchange measures potential laboratory bias. The QC data is recorded in both table and control chart and filed in the month upon which the samples were analyzed. Each laboratory is required to be AIHA (metals) and ELPAT (see Sec. 7.8) qualified for sample analysis by AAS.

InterLaboratory QC Program

Laboratory	AIHA	PAT	NVLAP	PCM	Frequency		AAS
					PLM	TEM	
International Asbestos Testing Laboratories Mt. Laurel, NJ	100188	100188	1165	4	4	4	2
DCM Science Laboratories Lakewood, CO	305	10758	1258	4	4	0	0
American Analytical Laboratories Akron, OH	300	44313	NA	4	4	0	0
Forensic Analytical Specialties Hayward, CA	413	11143	1459	4	4	4	2
FiberQuant Phoenix, AZ	NA	10873	10873	0	0	4	2
Accredited Environmental Technology, Inc. Media, PA	289	8637	1051	4	2	0	0
LabCor, Inc. Seattle, WA	NA	NA	1920	0	0	0	0
HUB Environmental Labs N. Quincy, MA	NA	NA	1643	4	0	0	0
Galson Corporation E. Syracuse, NY	NA	7966	1375	0	0	0	0
University of Iowa, Hygienic Lab. Des Moines, IO	NA	NA	NA	NA	NA	NA	2

4 = quarterly

3 = tri-annually

2 = bi-
annually

NA = not immediately available

7.11. Customer Complaints Client Communications

- 7.11.1. Review of Requests, Tenders and Contracts – Prior to the acceptance of samples for analysis from new clients, a practical and efficient procedure is in place to ensure that: clients have the resources to make proper payment for services and IATL has the resources and capability to provide the requested services. The first step is to have perspective clients complete an Application for Credit and submit it to IATL Accounts Receivable (AR) for review. AR will research credit histories and stated references, then determine approval based on the information supplied. The next step entails a review of the client-requested services by Management. The Laboratory Director communicates with the necessary departments (Administration, specific laboratory departments, etc.) to determine if the resources (instrumentation, personnel, etc.) are in place to properly fulfill the clients' needs. Analysis will only be completed for those parameters which fall within the pertinent scope of accreditation. In scenarios where clients request IATL to perform services which are not part of the pertinent scope of accreditation, the client will be notified in writing of the deviation. In addition, the analytical report (if one is issued) will not make reference to any regulatory authority or accrediting body. IATL has a responsibility to accurately disclose their capabilities to clients. As such, IATL provides all new clients with a "Statement of Qualifications" (SOQ). This provides most if not all of the relevant information regarding capabilities, experience, accreditations, qualifications, and the instrumentation employed. The listing of methods is well-defined (publication identification number, revision number, etc.) such that the client has a clear understanding of the methodologies to be employed. In cases where clients are not certain which method to employ, IATL has the responsibility to make the best determination, based on information provided by the client. After this determination, the client will be informed. Agreements made with clients regarding services to be completed may be either oral or in writing. Additionally, lab policies, fee schedules, chain of custody forms, and contact information are provided in the SOQ. For situations outside of IATL's standard practices and policies clients can confer with the customer service staff to ensure that all requirements will be met. For quality assurance purposes and matters of record all client contact is documented using the "TeleMagic" software package
- 7.11.2. Customer Assistance - Clients call IATL frequently. Many times these calls ask for assistance with technical problems. They may have questions about the interpretation of results. IATL staff is trained to first respond by saying that our assistance is limited only to those samples on which IATL has performed analyses. We can help with technical questions, but shy away from interpreting results when the consultant or engineering firm is responsible for, and should be aware of, the consequences of analytical results. Generally calls first are directed to the Customer Service / Marketing Representatives. Clients may then ask for technical assistance from technician staff and the Laboratory Director.
- 7.11.3. Customer Complaints: Review - The Laboratory Director shall be immediately informed of any customer complaints or customers disputing a sample analysis performed by the laboratory. In such a case, the original analysis shall be checked by retrieving the archived sample and all of that day's analytical QA/QC Worksheets and other associated paperwork. If necessary, the sample shall be reanalyzed and reviewed by the Laboratory Director. Many times insufficient sample size or consumption of original matrix material will prevent the re-preparation of the sample. When this happens, that day's QC data is made available to the client and a discussion will follow to assure the client of quality results. Often a miscommunication with the Preliminary Fax Result (see Section 7.4) is responsible for these complaints.
- 7.11.4. Customer Complaints: Corrective Actions - The laboratory director will communicate the finding to the client. If the sample was found to be misanalyzed, the analyst shall immediately be informed and the cause for the misanalysis determined. The quality control coordinator should document the course of action taken to resolve the problem and to prevent any similar problems in the future and a copy placed in both the personnel file of the analyst and the QC report sent to the client and filed.

7.12. System Audit

All disciplines throughout the laboratory have written procedures regarding QA practices. These include the participation in proficiency programs, Inter-Laboratory collaborative studies, and various forms of Reanalyses to assess instrument, analyst, and overall laboratory performance. Annually, a system audit must also be conducted for each laboratory discipline during the first quarter of the year. Additional audits are performed periodically by external technical evaluators. When audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, timely corrective action will be taken. See sections 7.8.1 through 7.8.8 for explicit steps to be taken. In the event that client results have been affected clients will be notified. Follow-up audit activities shall be performed as needed to verify and record the implementation and effectiveness of the corrective actions. This is in accordance with AIHA Industrial Hygiene Laboratory Program Policies Section 4.6.11.2, NYSDOH-ELAP requirements in Section 260 and 236, and NIST-NVLAP requirements in Handbook 150-13 Section 285.33.c.

Management Reviews shall be performed additionally. On an annual basis the laboratory's executive management shall review policies, audit results, proficiency and InterLaboratory results, assessments by external bodies, changes in the volume and type of work, client feedback, complaints, and other relevant factors to ensure the suitability and effectiveness of procedures and policies.

7.13. Document Control Policy

Throughout the laboratory there are numerous forms, manuals, and electronic forms in use. Each form is designed for a specific task. As needs and requirements change these forms must also change. To avoid confusion and or embarrassment on the part of the company and its employees it is important to keep only the most current forms in circulation. Control of documents is managed by keeping all original forms in a single place under the care of the QC Coordinator.

The document control spreadsheet lists each document. Documents are listed by a name which is assigned by the convention dept.funct.revisiondate(mmyy). Additionally recorded are the date of the last revision, a description of the forms use, to whom or where the document is to be distributed, and a list of changes made since the last revision. All documented forms are issued by the Laboratory Director.

Electronic forms are maintained by the QC Coordinator in an editable format and in a non-editable format where in use. (Lab File Server) They are write-protected and may only be changed by the Laboratory Director or designee upon approval.

When new forms are created or old forms are altered they must be reviewed and approved by the Laboratory Director prior to use. Newly approved forms can be filed as the old forms are removed. In some instances old forms must be retained, in this case old forms are stored in a "retired forms" folder. The document control Spreadsheet is then updated and reprinted in order to keep the file up to date. Hand pending forms is not permitted. Adjustments will be made and submitted for approval prior to implementation. Upon approval revised documents will be issued, outdated documents will be discarded or retired, and the document control list will be updated to include the new form or revision information. An annual review of the "Original Documents Folder is to be performed by the QAC to ensure the integrity of the Document Control Spreadsheet.

In the case of SOPs and QA Manuals the process is more detailed. The Document Control spreadsheet will be updated as is done with other forms to include a brief description of the changes. The manual itself will not be printed. Using the "Track Changes" feature of Microsoft Word allows review of proposed changes in direct comparison with the original documentation. If the revisions are approved by the Laboratory Director then the pages are copied and distributed to all who will be affected by the change. The document is saved including the tracked changes. It is then saved again as the next revision number and all changes are made permanent. The entire document is converted to Adobe PDF format and saved in a network directory available for review by IATL personnel. Auditing of the manual during System or Managerial review will begin with the changes since the last audit. The reviewed final copy will have digital signatures imported by the required parties.

The standard practice for IATL is not to use any external logos. Although we hold numerous accreditations only the name of the accrediting body and our laboratory ID are displayed on either our website or documents. Graphic logos which represent organizations not under direct ownership of PIATL will not be used. Should this practice change, IATL would strictly adhere to the policies (e.g. PJLA SOP-3, NIST Handbook 150-13, etc.) set forth by those organizations which hold ownership to the graphic logo.

8.0 Archiving

The ability to track the progress of a sample from collection through submission, from sample log-in through analysis, from sample review and approval through reporting, with ultimate archival or storage of the sample information (the raw and reduced data) is critical to the operation of a good industrial hygiene laboratory.

- 8.1. Digestates - Also archived are the sample remnants from both the preparation process (e.g. digestates) and the original material (e.g. soil sample). IATL stores digestates in a controlled room for up to 14 days before HazMat disposal. Any remaining sample is stored in archives either in-house or in our outside storage facility for up to one year.
- 8.2. Storage Containers - - Many times the samples are re-packaged after they are logged-in. This may include noting the client, date, and sample numbers on the outside of a 4mil poly ziplock bag. It is in these bags that the samples will eventually be archived. Bulk materials are archived for a minimum of one year in zip-lock bags and identified by laboratory tracking numbers. Samples are archived by analyst, date analyzed, and discipline (e.g. PLM, TEM, AAS etc.) The samples are archived for 3 - 6 months at the IATL facility and then shipped to our warehouse for further storage. See Section 11 for Waste Disposal.
- 8.3. Return of Samples to Client - Clients may request the return of samples in writing. A Chain of Custody will be furnished with "release" date, time, signatures etc. that will be transferred with the samples. A copy of the same will also be placed in the archives and client file. A copy of this form will be archived with the final report.
- 8.4. Records Retention and Retrieval - The files from previous months are stored in-house in secured file cabinets in the Storage Room. After one year, these are archived in a secure warehouse storage facility. Records are retained for ten years. LIMS records are also backed-up and archived. (See Section ii.2) The final approved COA is transferred back to the Laboratory Clerk. These individuals then copy *all* documents related to those samples, file as discussed above including raw data, COCs, COAs, processing notes etc., and mail original documentation to the client.

9.0 Samples of Laboratory Data & Reports

Several documents are mentioned throughout the SOP and QA Manual. This section will list those documents used by the laboratory to process metals and environmental lead samples. Copies of current formats are also attached. These forms are updated periodically. The "Originals" file located in the Laboratory Director's office maintains original copies of current forms. These forms were created using either MS Word or MS Excel and are also stored on the "Forms" disk stored in the same file.

- 9.1. Daily QA/QC Worksheet - This form contains all initial QC data that must be obtained before a run can be performed. It includes date of run, initials of preparation technicians and/or analyst technicians as well as a sign-off and date of the QA Coordinator or the Laboratory Director. Initial blanks and zeroing information of the instrument is included as is initial calibration standards, calibration verification standard, high standard, and other initial calibration results from SRMs. EXAMPLE ATTACHED
- 9.2.. Daily AAS Worksheet - This form contains all client numbers, IATL numbers, initial sample information (e.g. mass, volumes etc.), dilutions, and instrument results. The form also has room for the QC samples that must be run concurrently with a preparation batch. These include (see Section 4 and 7.1) CCV, CCB, LCS(s), Duplicates, Replicates, and Sample Spikes. EXAMPLE ATTACHED
- 9.3. Preliminary Results - This form is used for the following reasons: a) It provides a means of communicating analytical results to clients, b) it acts as a summary chain of custody, c) it outlines methods used, d) it reflects any common observances with samples (e.g. insufficient sample size etc.) and e) it can be supplied to the client with the written understanding that no QC data review of any sort may have occurred before the release of the Faxed data. The Preliminary Fax Results is only used to expedite results to clients. It is not a substitution for the thoroughly reviewed Certificate of Analysis! To ensure client confidentiality, faxes include verbiage to the effect that "This transmittal is intended solely for the company/individual listed as client above. If received in error please disregard and dispose of immediately." EXAMPLE ATTACHED.
- 9.4. Certificates of Analysis (COAs) - This is the final report used by IATL. The COA contains all information relevant to the client, sample, matrix, method, result(s) analyst, reviewer/approval, observations regarding unusual samples, disclaimers, limits of quantitation, and references to chain of custody documents. The COAs at IATL have undergone inspection and approval from all of the authorities that have evaluated our operation. The COAs are generated through the LIMS system, printed-out on letterhead, and arranged with an invoice. The LIMS provides IATL with the flexibility to customize our report formats in the database. Hence, IATL has separate COA formats for paint, soil, water, dust/wipes, and air samples. Furthermore, IATL has sub-COAs that reflect different variations of analytical methods within those matrices. EXAMPLE ATTACHED. The following is included:
 - 9.4.1. name and address of laboratory,
 - 9.4.2. unique ID of the test report,
 - 9.4.3. name and address of the client,
 - 9.4.4. description and ID of the test sample and date rec'd by IATL,
 - 9.4.5. identification of the test method,
 - 9.4.6. modification to the test method if applicable,
 - 9.4.7. name, title, and signature of the staff member accepting technical responsibility for the report
 - 9.4.8. date of issue.
 - 9.4.9. reporting limit for matrix standard prep. method.
 - 9.4.10. page numbers and total page count.
- 9.5. Data / Report Review - This document is prepared by either the QA Coordinator or the Laboratory Director from the AAS QA/QC Worksheet and the AAS Daily Worksheet. These reports are compiled QA data of various types. The reports are prepared using the software discussed earlier. Except for typographical errors, any corrections or additions to a test report that are made are documented in the QA Report. EXAMPLE ATTACHED.

- 9.6. Sample Management Report - If there exists a problem with the packaging of the samples a Sample Management Report is completed and attached to client paperwork.. (See Section 2.1) A Shipping, Packaging, Chain-of-Custody flier is also attached to the client's paperwork. (See attached) Both documents act as tools to document any observations, deficiencies, or problems that are noted upon receipt of the samples. This form is utilized to prevent improper sample packaging by the client. EXAMPLE ATTACHED.
- 9.7. Disclaimer List - Basic scientific principle is founded on the powers of good observation and the recording of the same. At IATL, our responsibilities as laboratory analysts extend to communicating observations regarding a client's sample. These observations may reflect unusual occurrences in materials or sample conditions. Often these disclaimers, beyond communicating sample observations, are used to COA or "cover our #*\$@!" The list has been compiled to aid our prompt notation of frequently observed conditions. The list continues to evolve. As such, the technicians are encouraged to add or amend items. The LIMS and typed comments from this list will appear on COAs. EXAMPLE ATTACHED.
- 9.8. Records Retention - Original data sheets are received by the Reports Personnel and / or the Laboratory Director from the analyst. The data is then entered into LIMS to produce Certificates of Analysis (COAs), reviewed by the Review Personnel, the QAC, and/or the laboratory Director. Reports Personnel then copy all data, reports and client paperwork for IATL archives. The original documentation is then mailed to clients in report form.

The files from previous months are stored in-house in secured file cabinets for six months to one year. After which these are archived in a secure warehouse storage facility. *Records are retained for ten years.* Prior to off-site storage records are to be indexed by box in a spreadsheet to include the following information;

- Public Storage Unit #
- Month and year of reports
- Range of client names by first initial, (i.e., c thru f)
- Anticipated date of disposal, (10 years to the month on the box)
- Date of Disposal

After disposal the spreadsheet must be updated to reflect this fact.

LIMS data is backed up daily and stored off-site indefinitely.

The final approved COA is transferred back to the Laboratory Clerk. These individuals then copy *all* documents related to those samples, file as discussed above including raw data, COCs, COAs, processing notes etc., and mail original documentation to the client. The word processing software information is saved, stored, and archived according to the first IATL sample number of each analysis set. Back-up of these disks are archived in secure files away from (different building) the standard disks that accompany the files. Clients may request the return of samples in writing. A Chain of Custody will be furnished with "release" date, time, signatures etc. that will be transferred with the samples. A copy of the same will also be placed in the archives and client file.

- 9.9. Test Report Corrections - Corrections or additions may arise from client requests. These changes from original sample log or chain-of-custody paperwork must be accompanied by a FAX from the client authorizing the change. If a correction or addition is made to a test report, a copy of the initial report [stamped COPY] and the newly amended report are both filed in the client's monthly file. Amended reports are given a new report number and include a disclaimer noting their amended status as well as reference to the initial report number and date.

10.0 Laboratory Health & Safety Program: Summary

IATL is committed to the safety of both its staff and the environmental beyond our building. As such we have implemented various procedures and practices that promote safety, anticipate hazards, and prepare for problems. The information here is only a summary. The Chemical Hygiene Plan adopted in 1992 and reviewed in each year is over 60 pages of procedures and record-keeping. Only an outline is enclosed for that component of our program. The New Jersey Right-To-Know (NJRTK) program requires us to submit a listing of all chemicals to various agencies throughout our state and local governments. This filing is only briefly listed here because of its length. Material Safety Data Sheets (MSDS) are also on display at IATL but are only mentioned as their content would be too lengthy.

- 10.1. Chemical Hygiene Plan - OSHA's "Occupational Exposures to Hazardous Chemicals in Laboratories," 29 CFR 1910.1450, requires employers to establish a chemical hygiene plan (CHP) to protect laboratory employees from exposure to chemical hazards. SEE ATTACHED COVER AND TABLE OF CONTENTS SUMMARY.

The CHP also details the communications program within the laboratory. The program consists of a four-fold approach to hazardous communications. The program stresses a) training, b) Right-To-Know program, c) record-keeping, and d) emergency response.

- 10.1.1 Training - The program stresses the initial training of laboratory staff to all chemical and occupational hazards within the laboratory. The CHP also lists all relevant MSDS, their locations, and emergency numbers. All safety instructions are given to each laboratory employee. As such, the employee must sign a CHP acknowledgment of training. The training also utilizes videos, respirator training, clean-up procedures, and spill control techniques. Each analyst has records of yearly safety training. The LTP is also not fully listed in this document. The first day of employment at IATL is solely occupied with Health and Safety Training (see Section 1.6.2). This includes a full review (8 hours) of the following:

1. 29 CFR 1910 Chemical Hygiene Plan as mandated by OSHA.

- 10.1.1 Training - (continued)

2. Spill Control Procedures and demonstrations.
3. Fire Extinguisher demonstration.
4. NJ Right-To-Know Listing
5. First Aid Stations, Eye Wash, and Shower procedures
6. Review of Facilities and Fire Exits
7. ADP Security codes, police, and fire alarms, etc.

- 10.1.2 Right-To-Know - This part of the communications program is registered with the New Jersey Bureau of Hazardous Substances. The attached RTK listing is on file with all emergency response agencies etc. These include the

1. Mt. Laurel Fire Department,
2. Mt. Laurel Police Department,
3. Camden County Emergency Planning Coordinator,
4. New Jersey Bureau of Hazardous Substances

- 10.1.3 Record Keeping - The Laboratory Safety Officer is responsible for recording chemical listings, training, MSDS, emergency responses, reviews procedures and reports progress to the Laboratory Director. All records are filed under the CHP, the LTP, and the NJRTK files.

- 10.1.4 Emergency Response - The final part of this program consists of an emergency response chain of communication that is listed in case of any spill, contamination, fire, or police emergency. The chain lists laboratory management, local police and fire departments. In case of spill etc. staff training procedures are initiated that include use of fire extinguishers, eyewash, spill control, etc. In addition, IATL also has on its security system, an automatic emergency response button for fire and police. Follow-up: In the event of contamination, spill, fire etc. The laboratory's CIH in conjunction with local officials, insurance specialists etc., will determine to what extent clean-up procedures must be documented to return to working status.
- 10.2. Supply Inventory - All reagents, gases, or chemicals of any kind are recorded and listed. Laboratory analysts are given instruction in the use, storage, and control of chemicals in the laboratory. In house analysis must be performed to ensure the quality of all reagents and standards prior to implementation. The monitoring of inventories is the responsibility of all analysts. Each analyst must be concerned with the supply of materials specific to his or her duties.
- 10.2.1 All tanks are secured by a chain mounted to the wall.
- 10.2.2 All reagents are logged in when received including supplier, expiration date, and lot number. All reagent bottles are marked with the date received, expiration date, initialed, and stored in the chem. prep room in one of three storage cabinets. Stock standards are discarded at or near the date of expiration printed on the label.
- 10.2.3 IATL maintains a list of multiple reputable suppliers for all consumables. Reputability has been determined by years of use and evaluation. Suppliers providing quality products, timely service, and low or lowest cost are categorized as "reputable". Although low cost is the objective quality is not sacrificed. Manufacturers should be ISO 9001 compliant and offer products that meet or exceed the requirements of the lab.
- 10.2.4 The purchasing process begins with the individual analyst. An order list is kept in the Sample Management room. As supplies run low the analyst must record the date, supply item, and description. In the case of irregular items the discipline in which it is to be used (eg; PCM), the catalog number and vender should also be noted.
- 10.2.5 The QAC generally performs the ordering of samples. In any case the procedure is the same. The ordering list is taken to members of the different departments and needs are re-evaluated and confirmed. A Purchase Order (PO) can then be filled out for each vender to include, vender name, phone number, and our account number in the top left portion of the PO. In the columns below the quantity requested, the catalog number, description, and the discipline for which it is to be used. The price per unit should be confirmed with the vendor if there is any uncertainty. When prices are entered and summed the POs are submitted to the Laboratory Director for approval, upon which the vendors are contacted by phone and the order placed. Any items on backorder must be noted in addition to the phone contact and a confirmation number. The PO is then maintained in the QAC office until all items have been received. The completed PO is then separated. The packing slips and copies of the PO go to accounting and original PO form is filed in the PO notebook .
- 10.3. Housekeeping - Some highlights of this program include the daily cleaning of work areas by each analyst. Cleaning procedures can be divided into four areas, a) Daily cleaning, b) weekly/monthly cleaning, c) post service cleaning, and d) post episode cleaning.
- 10.3.1 Daily Cleaning: - All sample preparation surfaces will be wet wiped before sample preparation and at the end of each day's operation. All sample prep tools will be cleaned by wiping with a wet wipe or water after each prep use. Laboratory blanks Pre and Post LCC wipes are a measure of lab cleanliness.
- 10.3.2 Weekly/Monthly Cleaning - In addition to a daily regimen, a weekly procedure will be completed to insure that all laboratory areas are clean. This includes wet mopping the laboratory floor and

reviewing waste management procedures from the previous week. Once per month an in-house Quality Assurance Air Monitoring Sample (QAAM) is collected in the environs of the laboratory and analyzed by TEM using NIOSH 7402 method for particulate contamination. Similar samples are collected by NIOSH 7082 and are analyzed by AAS to determine lead in air concentrations. Standard contamination response actions will be initiated if threshold values are breached.

- 10.3.3 Post Service Cleaning - After any laboratory service (renovation, manufacturer's representative to service instrumentation etc.) the weekly/monthly procedures are initiated.
- 10.3.4 Post Episode Cleaning - After any laboratory exposure to chemical or materials waste is observed, full clean-up procedures are enacted. These include the absorption of waste using spill kits etc. wearing protective gear and respiration. Air monitoring, and follow-up documentation by industrial hygienist is required. Hazardous materials disposal may need to be initiated at the recommendation of the staff consultant CIH.
- 10.4. Personal Protection - All technicians who work in the Chem Prep Room, AAS Room, Misc. Prep Room, or Air Prep Room, are required to wear personal protective equipment (PPE). Any analyst caught not wearing PPE will be reprimanded in writing by the Laboratory Director. The LSO will record any PPE violations and place a copy in the analyst's LTP file. The analyst will also be reminded of training procedures, code of ethics, MSDS guidelines, etc. Protective gear may include:
- 10.4.1 Safety Glasses
 - 10.4.2 Disposable gloves
 - 10.4.3 Chem resistant apron
 - 10.4.4 Lab coat
 - 10.4.5 Heavy Nalgene gloves
 - 10.4.6 Half-mask respirator
 - 10.4.7 Long Pants
 - 10.4.8 Non-open top shoes
 - 10.4.9 Knowledge of spill controls, emergency procedures, and how to summon help!
- 10.5. Spill Procedures - IATL stresses prevention in all laboratory safety training reviews, but it is also necessary to anticipate episodic spills or releases of contamination. Hence, IATL does cover spill control in its LTP. Procedures are also posted in the Chem Prep Room, AAS, and Misc. Prep Rooms.
- 10.5.1 Small Spills - If acid is spilled in the hood or on the counter-tops in quantities less than 50ml, neutralize using sodium bicarbonate and wipe up with paper towels. These may be disposed of in plastic bags, tied, and transferred to standard trashcans within the laboratory. Small organic spills of less than 25 mls can be cleaned using paper towels.
- 10.5.2 Large Spills - Large spills consist of any quantities over 50ml of concentrated acid or over 25 ml of any organic solvent or reagent. IATL employs spill control kits for these episodes. They consist of acid or organic polysorb sponges for smaller spills (<1L). These may be used and sealed in a plastic nalgene drum after use. They are diluted with tap water and cleaned with soapy water utilizing the laboratory spill mop located in the dark room. Larger spills (>1L) require the boom to prevent leakage into other rooms. IATL does not use over 2.5L containers for concentrated chemicals.
- 10.5.3 Emergency Spill Response - When acid or chemicals make contact with skin or eyes, then emergency procedures for washing clothes, skin, eye flushing, soaker hose, must be initiated! Call for assistance. Use first aid kit(s) in prep rooms. Inform Laboratory Director. Interview with Laboratory Safety Officer. Report filed with local Health Authorities, insurance company, or state workers compensation may have to be completed. Staff CIH to be informed!
- 10.6. MSDS - As part of our Chemical Hygiene Plan (CHP). IATL posts a full compliment of Material Safety Data Sheets (MSDS). The Laboratory Training Program includes review of these sheets. Three-ring binders of MSDS records are available in the Laboratory Library and the Chem Prep Room. The Laboratory safety Officer (LSO) will be able to interpret these records for any employee.

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11.0 Laboratory HazMat / Waste Disposal

The CHP covers the handling and waste removal of all waste products. Waste management is documented through contractor manifests. IATL generates four types of waste in the following amounts:

11.1 Bulk Asbestos Samples.

These are building materials (e.g. floor tiles, insulation products, etc.) that are sent to IATL for testing. IATL archives these samples for 6 months at our laboratory facility and an additional three years at a secure storage warehouse. In general, the amount of material thought to be asbestos containing is less than 1 percent by weight of the material. When IATL finally disposes of these samples, an independent asbestos waste hauler (Archway Contractors) is contracted to remove and provide manifests for completed removal.

IATL generates approximately 25 "bankers boxes" per annum of this material.

11.2 Acid Waste.

The acid digestion procedure for lead in paint preparation steps requires nitric acid. The waste stream here consists of 50ml of <pH 2 (EPA D002 / D008) material for each paint chip or dust/wipe sample. IATL archives these vials for only one or two months before transfer to 55-gallon drums. Waste drums remain on site until they are full. There may be trace organic waste with the acid derived from samples.

IATL produces approximately 350 gallons of this waste per annum.

11.3 Organic Solvent Waste.

The various preparation steps involved in TEM analysis include two organic solvents. Either DMF or Chloroform are used to dissolve the MCE and PC filter membranes respectively. The waste is drained into Safety cans for storage. IATL has contracted Detrex to dispose of this waste stream.

IATL produces approximately 5 gallons of organic waste per annum.

11.4.1 Lead Bulk Waste.

This waste stream originates from client submittals of bulk paint samples for lead testing. Many times clients submit only enough sample to be tested (~300mg) and the process consumes most of the sample. Any remaining portions of samples are archived in individual ziplock bags, batches of client sample bags within another larger ziplock bag, and these batches in banker's boxes labeled with date and sample ID information. The boxes are archived in the lab for six months, transferred to the warehouse storage facility for another six to twelve months before disposal regimens are enacted (see next page). The following statements, from the sources indicated, have been considered in the development of IATL's disposal policy for these materials. (see next page)

IATL produces approximately 350 kg of bulk lead waste per annum.

11.4.2 Lead Bulk Waste.

"A solid waste containing more than 200ppm of Pb may fail the TCLP (Toxicity Characterization leaching procedure) used to define a hazardous waste (US EPA SW-846 Method 1310 and TCLP, followed by Methods 3050/6010). By failing the TCLP, a waste is classified as hazardous and consequently requires special handling and disposal. Therefore, steps must be detailed in an SOP for the handling of potentially hazardous waste to include compliance with applicable local, state, and federal regulations."

Pb-Based Paint Laboratory Operations Guidelines: Analysis of Pb in Paint, Dust, Soil. Revision 1.0, May 14, 1993

"(a) The following materials are not regulated as hazardous waste for the purpose of this sub-chapter: 12. Samples of solid waste or water, soil, or air, which are collected for the sole purpose of testing to determine their characteristics or composition. i. This exception is only applicable when ... (1 thru 6 examples)"

NJAC 4:26-8.2 Exclusions: Hazardous Waste Regulations, December 1993 NJDEP

"Waste characterization is necessary because more stringent controls may be legally required for handling solid wastes that are also hazardous wastes. In the absence of prior knowledge of the properties of the waste to be generated, some wastes may require laboratory testing. Note, however, testing is not required to determine whether waste is hazardous. Instead, the waste generator is required to have knowledge of whether the waste meets the criteria for hazardousness. This knowledge can be obtained through testing or prior experience with the waste in question."

"When prior experience is not adequate to determine whether or not wastes are hazardous, qualified laboratories should perform appropriate toxicity test on representative samples of the wastes generated."

Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement, March 6, 1990, EPA/HUD Chapter 11: Waste Disposal Section 11.1.1.3

IATL has kept surveys of monthly paint sample results. Typically the consumed portion of samples averages around 0.012% Pb by weight (120ppm). Considering, most samples are consumed, and the additional weight of ziplock bags, IATL can demonstrate that paint wastes are less than the threshold of 200ppm. Regardless of this experimental data, and with the above directives under consideration, IATL has established the following disposal procedures.

IATL will pull all bankers boxes slated for disposal from our secure warehouse facility. A random sampling will be performed on each box. An environmental technician from a firm outside of IATL employment will be selected to pull random sampling in conjunction with NJDEP/EPA TCLP Sampling protocol. Each sample (a composite of paint samples) will be 500 to 1000 mg of paint debris. The paint debris samples will be sent to AnaLab of Edison NJ, a certified CLP laboratory. TCLP results under the 200ppm level will be defined as non-hazardous and will be disposed of without special consideration. Those samples over that threshold will indicate the entire box to be hazardous and disposal with NJDEP Waste Manifest will be served through certified haulers such as Archway Abatement Contractors or Direct Environmental.

12.0 Glossary (AIHA Re-Print)

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